Retirement and Health: Evidence from England

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Abstract

This paper utilizes census records, inpatient records, comprehensive surveys, and mortality records from England to trace out the effect of reaching retirement age on retirement status and health outcomes. Applying a regression discontinuity design leveraging the pension age, I find that retirement substantially improves well-being and reported health. I find no immediate effect of retirement on behavioral outcomes and no evidence of changes to cognitive ability, utilization, or mortality. While prior literature has considered the effects of retirement on specific outcomes, this paper systematically examines the full range of health-related outcomes with administrative and survey data in a unified context.

JEL Classification Codes: I12, J14, J26

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1 Introduction

Life expectancy has jumped dramatically in the last century, with much of the change concentrated in life expectancy at birth. However, health conditional on age has also improved substantially, and life expectancy at advanced ages has seen large increases. Entitlement programs for the elderly have only recently begun to adjust to these changes. In England, the state pension age has been constant for men since 1925, while life expectancy for British citizens at age 50 has increased from 75 in 1955 to 82.6 in 2011 (Human Mortality Database). Similarly in the United States, the age for full retirement benefits under social security has increased just one year since the program's inception in 1935, while life expectancy at age 50 has increased by 8.8 years (CDC). This trend has led policymakers to consider and implement increases in the normal retirement age as governments face budget shortfalls due to an increase in the average duration of retirement.

These policy debates have spurred an increased interest in the link between retirement and health outcomes. Leaving the labor force releases many individuals from day-to-day sources of stress and greatly increases leisure time. In the cross section, however, health deteriorates with age, and acute changes to health can push individuals into retirement earlier than expected. This interdependence has made it difficult to accurately assess what effect retirement has on lifestyle and health outcomes, and the direction of this relationship is theoretically ambiguous. Providing labor is often stressful and taxing, and relieving an individual of this burden may improve the individual's health (Ekerdt, Bosse, and LoCastro 1983). Yet it may also be the case that retirement leads to a loss of well-being, as individuals often lose the social network of their coworkers and may feel less useful to society (Szinovacz, Vinick, and Ekerdt 1992). Empirical studies that adjust for observable differences have often found negative effects of retirement, but some researchers have found positive effects as well.[1] More recently, researchers have attempted to disentangle this relationship using variation in retirement probabilities induced by pension rules (Kofi Charles 2004, Gorry, Gorry, and Slavov 2016), early retirement incentives (Kuhn, Wuellrich, and Zweimüller 2010, Bloemen, Hochguertel, and Zweerink 2017, Hernaes et al. 2013, Hallberg, Johansson, and Josephson 2015), or cross-country differences (Coe and Zamarro 2011), yet results have been inconclusive, with some finding beneficial effects of retirement and others showing starkly detrimental effects – including on the likelihood of mortality.

I contribute to the literature by comprehensively tracing out the effect of reaching retirement age on individual's lifestyles, health care utilization, health outcomes, and chances of mortality. I focus on England due to a clearly defined age-based pension rule and a lack of any confounding programs in the same age range. In particular, retirement does not coincide with a change in access to or cost of health care, and there is no early state pension age that may induce a portion of the population to retire at a different age. This setup lends itself to applying a regression discontinuity design around the pension age. By using a multitude of data sources – including census data, inpatient records, large cross-sectional and longitudinal surveys, and mortality records – I am able to provide both precise estimates and multiple estimates for the same outcomes, ensuring robustness of results. As such, I am able to provide an exhaustive view of the transition individuals face upon reaching the pension age.

I break the causal chain of retirement into four stages. The standard first stage is to verify reaching the state pension age increases the probability of retirement. Next, I examine

1. Minkler (1981) gives a review of the idea that retirement harms health, including some correlational studies that show null or positive effects on health.

behavioral and environmental changes that could affect an individual's health status. This includes health behaviors – such as smoking, drinking, exercising, and regular contact with friends and family – along with health care utilization, the change in environment of daily activity, and the additional income from the state pension. Following this, I investigate health outcomes, which can be split into self-reported measures, such as reported well-being and general health, and objective measures, such as inpatient admissions, scores on cognitive tests, and vital signs. The final step is mortality. These classifications are useful for analyzing the mechanisms through which retirement can change an individual's health status.

Recent quasi-experimental studies provide an ambiguous picture of what effects retirement should have on health. Kofi Charles (2004) and Neuman (2008) use age-specific cutoffs as instruments for social security in the U.S., finding a positive effect on self-reported well-being, but no effect on health outcomes. Conversely, Coe and Zamarro (2011) use cross-country variation in pension rules in Europe and find a strong positive effect on health outcomes but null effects on health behaviors. Bloemen, Hochguertel, and Zweerink (2017) and Hallberg, Johansson, and Josephson (2015) use targeted retirement programs that induced early retirements, with both finding positive effects on mortality rates. In contrast, Kuhn, Wuellrich, and Zweimüller (2010) also uses exogenous access to early retirement and find *negative* effects on mortality rates, while Hernaes et al. (2013) do not find an effect in either direction. Two recent studies focusing on the social security age in the U.S. have found vastly different results. Gorry, Gorry, and Slavov (2016) use the social security eligibility age and eligibility for employer pensions as instruments to show that retirement improves both health and life satisfaction. Using the same population and age in an RD setting, Fitzpatrick and Moore (2016) find that retirement induces a sharp increase in mortality rates. In the closest application to the methodology applied here, Weemes Grøtting and Lillebø (2018) find no effect on health care utilization and mortality in Norway.

Various factors could result in these seemingly contradictory estimates, especially the application of different research designs to different populations in different countries. Further, these papers often face data limitations that impact estimation and institutional factors that impact identification. Thus, instead of focusing on a narrow set of outcomes, this paper seeks to trace out the outcomes in the causal chain of retirement and health within a unified context. Using multiple data sources for contemporaneous cohorts of retirees in the U.K., I mimic the methods utilized in previous works to generate a rich picture of the transition an individual faces when leaving the work force. This integration of administrative records and comprehensive surveys from the same population allows for both a much larger sample size and robustness checks not available to other researchers.

I first find that reaching the state pension age induces a large portion of the English population to retire. This effect is somewhat larger for men than for women, with the latter able to collect the state pension at a younger age. Further, this effect is nearly twice as large for those without post-secondary education.

I show that that retirement substantially improves individuals' self-reported health. I find that retirement reduces the proportion of people that report being in poor health, and the probability that they report having a persistent health problem. This result is significant across data sets and robust to specification changes.

Next, I investigate potential sources of this abrupt improvement. I find no evidence of an immediate change in health care utilization, and limited evidence of positive effects in health behaviors such as frequent exercise, smoking, and social contact. In contrast with previous results, I find no evidence of an immediate change in cognitive and memory scores. I do, however, show that individuals show signs of lower stress in both subjective and objective measures, and that they report higher life satisfaction. I further show that they substitute their time from working into sleep and leisure. Congruent with these results, death certificate data show that there is no effect of retirement on mortality.

These results advance the understanding of the relationship between retirement and health in several important ways. The first is that individuals clearly report better health after retirement, but show little movement in key outcomes such as utilization, cognitive ability, and mortality. This confirms recent studies showing that the negative correlation between retirement and health is an artifact of the endogeneity of the retirement decision, and suggests that the effect is due to no longer providing labor rather than healthy behavioral changes by the individual. This fits with a large neuroscience literature on long-term effects of stress on overall health.[2] Next, this paper shows that many results are sensitive to data source and research design, and my approach allows for extensive robustness checks. This indicates that studies using a specific data source should be interpreted cautiously when discussing external validity. Perhaps most importantly, the approach taken in this paper provides a clear framework to think about how retirement could affect the most salient health outcomes, such as mental health, utilization, and mortality. Without negative effects in health behaviors and health outcomes, it is difficult to conceive of a mechanism that would cause retirement to be linked to cognitive decline or increased mortality rates in a short- to medium-term time frame.

The rest of the paper proceeds as follows. Section 2 examines previous work on the link between retirement and health, and provides institutional background on the state pension.

2. See, for example, Cooper and Marshall (2013), or Sapolsky (2004) for an accessible review.

Section 3 details the data sources used and identification strategy. Section 4 gives results, and Section 5 compares results directly to previous literature and concludes.

2 Background

2.1 Retirement and Health

Early work on the relationship between retirement and health frequently stemmed from the psychology literature and broadly characterized the associations between retirement and subjective well-being. A strong majority of these studies conclude a negative relationship, with retirement associated with lower life satisfaction (Bossé et al. 1987), depression (Portnoi 1983), and lower well-being (Atchley and Robinson 1982, Grâce et al. 1994, among others). This relationship is also reported for physical ailments, such as cardiovascular disease (Moon et al. 2012). These studies describe the negative relationship when individuals retire, but lack the capacity to take the endogeneity of the decision into account. Without this, it is not possible to conclude whether this negative relationship is because of retirement, or if those in poor health are simply more likely to retire.[3]

More recently, researchers have attempted to disentangle these effects using a variety of techniques. As mentioned previously, this includes long-standing retirement and pension rules, early and unexpected retirement incentives, and cross-country variation. Regardless of identification strategy, these studies tend to focus on a particular subset of health-related

3. There is an extensive literature examining the relationship between retirement and health that corrects for observable characteristics, and many of these studies find the negative relationship discussed above. However, others have found positive effects of retirement. Mein et al. (2003) examine civil servants and show that mental health worsened for those that continued working for high socioeconomic status individuals. Westerlund et al. (2009) find that retirement reduces the proportion of French gas and electric company workers that report being in poor health, although this same group did not have decreased episodes of respiratory disease, diabetes, coronary disease, or fatigue (Westerlund et al. 2010). Jokela et al. (2010) find a negative effect on mental health for those that retired due to ill health, but a positive effect for those that retired voluntarily or at the pension age. Lupton et al. (2010) find that a later retirement delays the onset of Alzheimer's disease, and Butterworth et al. (2006) that only that those retired early had significantly worse mental health. Drentea (2002) show that retirees report less anxiety and distress, but is not associated with symptoms of depression, and Midanik et al. (1995) find less reported stress for retirees.

outcomes.

Of these, health behaviors have been given the least attention. These outcomes are often difficult to measure, and are potentially more subject to biases inherent to surveys. Insler (2014) used individuals' predicted retirement age from the Health and Retirement Survey (HRS) as an instrument to find that retirement increases exercise and decreases smoking. Using pension rules in Germany, Eibich (2015) show that retirement increases activity, sleep, and leisure time activities, and that it decreases smoking rates and BMI. Müller and Shaikh (2017) used the Survey of Health, Ageing and Retirement in Europe (SHARE) in an RD design to show that a spouse's retirement increases physical activity, but also increases cigarette and alcohol consumption. Motegi, Nishimura, and Terada (2016) also find that retirement increases exercise for Japanese retirees, but show that retirement *reduces* drinking and does not change smoking rates.

In contrast, the effect of retirement on health outcomes has been extensively studied. Within this broad category, the effect on mental health and cognitive ability have been of particular interest. Kofi Charles (2004) was the first to examine this relationship with a causal argument, using both the age of Social Security benefit eligibility and a change in laws affecting when Social Security can first be withdrawn. With this, he finds retirement has a positive effect on mental health measured with two indicators for loneliness and depression. Rohwedder and Willis (2010) investigate the observation that countries that have a larger proportion of the work force working later in life also have a smaller difference in cognitive performance between older and younger men. Using cross-country variation in eligibility ages for early and full public pension benefits, they find that retirement reduces cognitive scores by nearly 1.5 standard deviations. This finding kicked off a wave of interest in the topic. Leveraging eligibility ages as instruments, Bonsang, Adam, and

Perelman (2012), Mazzonna and Peracchi (2012), and Tumino et al. (2016) find a negative effect on cognitive function, although Coe and Zamarro (2011) do not find any effect. Coe et al. (2012) also does not find an effect using exogenous offers of early retirement windows. However, Bingley and Martinello (2013) point out that cross-country differences in eligibility age is invalid as an instrument without education controls due to being correlated with differences in years of schooling, and argue that failing to include these controls can explain some (but not all) of the negative effect of retirement on cognitive function.

With a persistent notion that retirement harms health, the relationship between retirement and physical health has also been examined extensively. Of course, the way in which physical health is measured varies widely, with subjective measures frequently used due to their ease of collection in surveys. Coe and Zamarro (2011) use early and full retirement ages across European countries as instruments to show substantial positive effects of retirement on self-reported health. Neuman (2008) finds similar results in the U.S., also using early and full retirement ages as instruments. Gorry, Gorry, and Slavov (2016) uses a similar set of instruments in the U.S. and also find that retirement improves self-reported health and life satisfaction. Insler (2014) instead uses individuals' expected retirement age as an instrument, again finding positive effects on self-reported health status.

Works using different identification strategies have shown similar results.[4] Using the Health Survey for England in a regression discontinuity setting, Johnston and Lee (2009) find positive effects of retirement on self-reported health and mental health.[5] Bound and Waidmann (2007) compare trends before and after the state pension age in England and find a small positive effect on physical health for men, as measured by self-reported mea-

4. Dave, Rashad, and Spasojevic (2008) does find negative effects on mobility and daily activity as well as the number of health issues. Later studies, however, show that simply including individual-level fixed effects is not likely to account for all unobserved selection. Insler (2014), for example, directly compares a fixed effects model to the FE-IV model and shows that negative effects can be reversed or nullified with the latter approach.

5. This work is essentially replicated as a part of this paper, with consistent results.

sures and blood tests. The RD design used by Eibich (2015) also reports an improvement in self-reported health, as does Zhu (2016) evaluation of a change in the Australian pension eligibility age.[6] Behncke (2012) combines the IV model with propensity score matching using the ELSA in England, concluding that retirement increases the probability that an individual is diagnosed with a chronic condition.

As part of the effect of retirement on health outcomes, some studies have included outcomes related to the effect on healthcare utilization. This has particularly important policy implications, as changes to retirement eligibility ages could significantly impact the budgets of government healthcare programs. Eibich (2015) finds that retirement reduces the number of annual doctor visits but not the probability of a hospital admission, while Hallberg, Johansson, and Josephson (2015) does show a reduction in the number of hospital inpatient days. However, Lucifora and Vigani (2018) find an increase in the number of doctor's visits, and Gorry, Gorry, and Slavov (2016) and Weemes Grøtting and Lillebø (2018) find no effect on utilization.

With limited evidence that retirement affects health behaviors and mixed evidence on health outcomes, it seems unlikely that leaving the labor force could cause immediate changes to the probability of mortality without substantial contemporaneous changes to life circumstances. Nevertheless, multiple studies have founds effects in this area. Bloemen, Hochguertel, and Zweerink (2017) use an exogenous shock to retirement eligibility for a group of public employees in the Netherlands to estimate the effect of retirement on the probability of mortality within five years. They find that retirement decreased the probability of mortality by 2.5 percentage points. Hallberg, Johansson, and Josephson (2015) finds similar effects with a similar program for Swedish army officers. Conversely,

6. This change in the eligibility age — increasing the eligibility age at a rate of six months every two years – is similar but not identical to the one implemented by the UK starting in 2011.

Fitzpatrick and Moore (2016) use the Social Security age in the U.S. in a regression discontinuity setting to estimate an *increase* in the probability of mortality by 2 percentage points for men, and Kuhn, Wuellrich, and Zweimüller (2010) find similar effect sizes using an exogenous change to unemployment rules in Austria. Finally, Hernaes et al. (2013) finds no effect on mortality among Norwegian workers exposed earlier to a rollout of early retirement rules, and Bound and Waidmann (2007), Coe and Lindeboom (2008), and Weemes Grøtting and Lillebø (2018) find no effect on mortality.

2.2 England State Pension

The English State Pension system has been the subject of intense political discussion and action in recent years, with political parties making reform a key part of their platforms and legislation. Here, I provide context for this debate and details for how the pension applied to the population examined in this study.

The system began in 1908 with the Old Age Pensions Act, which gave a maximum of 5 schillings a week – or 7 schillings 6 pence to married couples – to qualified individuals over the age of 70.[7] The full amount was given to those that earned 21 pounds per year, and reduced for those that earned more, up to a maximum of 31 pounds and 10 schillings in earnings per year. Nearly 600,000 individuals were granted the pension upon implementation of the law, which was to be funded by younger generations. At that time, life expectancy at 70 was just under 10 years (Office for National Statistics).

In 1925, the first contributory pension system was introduced. The Widows', Orphans', and Old-Age Contributory Pensions Act was based on contributions paid by both the em-

7. Individuals that did not qualify included those that received poor relief, "lunatics" in a state of asylum, ex-convicts that had been out of prison for less than 10 years, individuals convicted of drunkenness, and individuals guilty of "habitual failure to work". Further, there was a "character test", requiring recipients to be in good character.

ployer and the employee, and removed the means-test while also lowering the age of eligibility to 65. Importantly, the higher rate for married couples was only paid after both individuals reached their 65th birthdays. This was altered in 1940 by lowering the eligibility age for women to 60. The National Insurance Act 1946 made contributions to the state pension mandatory, insuring universal social security.

The next reforms to the basic state pension did not come until 1995, with the Pensions Act 1995. This raised the pension age for women to 65 as well, with the change happening gradually from April 2010 to April 2020 based on birth date. The pension age was further increased for both genders to 68, with the change scheduled to take place between 2024 and 2046. Finally, this law also lowered the number of years of work required for full payment for both genders to 30. With a change of government in 2010, the Conservative Party decided to increase the pace of gender equalization with the Pensions Act 2011, which pushed the date of equal pension ages to November 2018. Further, the law scheduled the increase for both genders to move from 65 to 66 from November 2018 to October 2020.

In addition to the basic state pension, the UK has had several earnings-based pension schemes sponsored by the government. The State Earnings Related Pension Scheme (SERPS) ran from 1978-2002, with employees contributing over their working lives to receive a portion of the earnings above a "lower earning limit", which was about the amount of the basic state pension. At the outset of the scheme, individuals received 25 percent of their earnings, although this was lowered to 20 percent in 1988.[8] The pension was proportional to the number of years spent contributing for those that retired before 1998. Further,

8. Specifically, the pension was calculated by taking the total yearly earnings that fell between the "lower earning limit" and the "upper earning limit" in a tax year, then dividing this number by 4 (from 1978-1998) or 5 (from 1988-2002, although this was phased in). This amount is then divided by the number tax years that the individual made contributions.

employers could choose to opt out of SERPS if they had a final-salary pension scheme, and in turn would pay reduced National Insurance contributions.

SERPS was replaced in 2002 by the State Second Pension (S2P), with the goal of increasing payouts to low-income earners. S2P operates similarly to SERPS, but treat earnings below the lower earning limit as if they were at the threshold, and redistributes the percent of total earnings – from 20 percent for all levels to 40 percent for earnings at the lower earning limit, 10 percent for those in the middle, and 20 percent for those at the upper earning limit. The reform also included individuals with long-term illnesses and disabilities who had previously only been eligible for the basic state pension. The S2P, however, is in the process of being phased out. Following the Pensions Act 2014, for those that reached the state pension age after April 6, 2016, a more generous flat-rate state pension payment of £155.65 per week.[9]

Individuals are allowed to continue working while receiving the state pension. Additionally, personal pensions registered with HM Revenue and Customs (HMRC) can be contributed to tax-free within certain limits. Contributions are tax-free if they are under 100 percent of yearly earnings, £40,000, and £1 million in an individual's lifetime. Personal pensions can be accessed without a tax penalty 10 years earlier than the state pension age.

As discussed below, this paper uses data from 1990-2011. The full pension benefit varied over this time period, but was capped at £102.15 per week in 2011. Increases occurred annually at a rate that was the highest of the average percentage growth in wages in Great Britain, the UK CPI, or 2.5 percent.

9. During a transitional period, this amount could be higher if expected S2P payments were over a certain amount. The amount can also be higher if an individual chooses to defer payment, at a rate of 5.8 percent per year increase.

3 Data and Methodology

3.1 Data Sources

I use multiple comprehensive data sources to obtain a clear picture into the transition individuals face at retirement. Table 1 provides an overview, with further details below.

First, I use data from the 2001 and 2011 England and Wales Censuses. The Census of the United Kingdom takes places on a decennial basis, and is conducted by the Office of National Statistic (ONS) in England and Wales. With mandatory participation, these data allow for nearly universal information on an individual's labor market status, as well as the populations in each month-of-birth cohort.[10] For 2011, this gives a sample population of just under 57 million.[11] In addition to retirement information, both censuses include two questions on individuals' health, asking how their health was in general and if they have a long-term disability or illness.

Inpatient data come from the Hospital Episode Statistics (HES) database, which contains all inpatient records for NHS hospitals in England. I utilize all completed admitted care events from 1990-2010, stacked by age. This gives a near complete census of admission records for this time period, allowing for precise estimates of changes to health care utilization. This allows for examination of changes in inpatient counts at the pension age, both for emergency and elective admissions.

Next, I use a number of large-scale surveys conducted in England and Wales. Of these, some are cross-sectional in nature and others have a panel structure. For those that are a panel, I also stack across waves when utilizing an RD framework.

The English Longitudinal Survey on Aging (ELSA) is a household survey examining

10. Those who do not fill out a census form face a maximum fine of £1,000 and a criminal record.

11. Due to privacy constraints, these data were provided in aggregate form. This also true for the inpatient and mortality administrative data. While this does not bias estimates, it does prevent the application of the IV approach and limits heterogeneity analysis.

the health and quality of life of the elderly. It is modeled closely after the Health and Retirement Study (HRS) that takes place in the United States, with many of the same questions asked. I use the Harmonized ELSA files that are designed to imitate the RAND HRS files, such that variable names and definitions line up closely. This allows for easy comparison of results with other work in the retirement and health literature that utilize the HRS.[12] These files use waves 1-6, which were conducted from 2002 to 2013. The first wave consisted of 11,050 respondents all above the age of 50. The survey asks a comprehensive set of questions, allowing it to be used for retirement outcomes, health behaviors outcomes, and health outcomes.

The British Household Panel Survey (BHPS) was conducted from 1991-2009 by the Institute for Social and Economic Research (ISER) at the University of Essex. The survey was done annually for each adult member of a nationally representative sample of households, giving about 10,000 respondents. The enumerators also followed adult children if they split from the original household, and included all adult members of the new household as well. The questions are wide-ranging in nature and are designed to examine social and economic changes at the household and individual level. This dataset also includes more refined birth cohort measures, allowing for improved RD estimates. The BHPS asks an even more wide range of questions than the ELSA, and it can be used for retirement outcomes, health behavior outcomes, and health outcomes.

The Health Survey for England (HSE) is an annual survey put on by the Information Centre for Health and Social Care and the Department of Health. It has been ongoing since 1991, with about 8,000 adults and 2,000 children responding each year. After information is collected with an interview, a specialty nurse will visit if the participant agrees. I use

12. Some examples include Bonsang, Adam, and Perelman (2012), Insler (2014), and Gorry, Gorry, and Slavov (2016).

data from 2000-2009, giving nearly 150,000 responses. The HSE is cross-sectional, and is used for retirement outcomes, health behavior outcomes, and health outcomes.[13]

The England Labor Force Survey is a large survey on labor market conditions that is conducted quarterly. I use data from 1992-2001 for a sample population of 6.1 million. Here, the data is used for the purposes of garnering another estimate of the effect of the State Pension Age on retirement status with a question asking if the individual worked in the previous week.

The Wealth and Assets Survey (WAS) is a longitudinal biennial national survey focusing on household wealth. I use this survey from the inaugural wave in 2006, and it is used to examine household assets, income, and wealth over time.

Finally, mortality data is provided by the Office of National Statistics (ONS). This includes counts of deaths by age, gender, and underlying cause. These data include all deaths that occurred in England between 1990 and 2011.

3.2 Methods

The question of interest is the effect of retirement on health, namely,

$$H_i = \beta_0 + \beta_1 R_i + \varepsilon_i \tag{1}$$

where R_i denotes the retirement status of individual i and H_i is the individual's health status. Retirement status could be endogenous, as a negative health shock could induce an individual to retire. To circumvent this, the primary approach in this paper is a regression discontinuity (RD) design, leveraging the threshold in eligibility for the state pension at the retirement age. This threshold allows for a clean examination of retirement, as —

13. ELSA respondents are drawn from respondents to the HSE. However, respondents are not in the both surveys in the same year.

unlike in the United States — there are no other major benefits to reaching that age.[14] I use the following standard RD equation.

$$H_a = \alpha_0 + \alpha_1 PensionEligible_a + \alpha_2 Age_i + \alpha_3 Age_a * PensionEligible_i + \\ \alpha_4 Age_a^2 + \alpha_5 Age_a^2 * PensionEligible_a + \varepsilon_a \tag{2}$$

where $PensionEligible_a$ is a dummy indicating if an age cohort (or individual) is older than their age required to be eligible for the state pension. This produces reduced form estimates that can easily be re-scaled by the proportion of people that retire at the eligibility threshold. I use a bandwidth of 5 years when refined age measures are available and 10 years otherwise. Optimal bandwidth procedures (for example, Calonico, Cattaneo, and Titiunik 2014) suggest using bandwidths between 3 years and 12 years depending on the data source and outcome, with suggested bandwidths for sources with refined age measures generally around 3-5 years and suggested bandwidths for sources less refined measures around 8-10 years.[15] Robustness to bandwidth figures for key results are shown in the appendix, with full robustness checks to bandwidth and linear polynomial in age on request.

One concern is that surveys may oversample retirees due their increased availability. Figure F1 shows that this is unlikely to be true, with age densities smooth across the state pension threshold for both genders.[16] Table F1 further shows that demographic character-

14. The only additional benefits to reaching retirement age is free local bus travel and annual winter fuel payments. Winter fuel payments are one-time tax-free payments made to eligible household in November or December and range from £100 to £300. These payments are sent automatically to those receiving the state pension. Prior to 2010, the payments were made if anyone in the household was over age 60. Angelini et al. (2019) find no effect of winter payments on health or household temperature.

15. As examples, the procedure developed in Calonico, Cattaneo, and Titiunik (2014) and Calonico et al. (2016) recommends a bandwidth of 9.4 years for the outcome of good self-reported health from the ELSA, 9.1 years for fair, and 9.1 years for bad; similarly, 7.6 years, 10.1 years, and 8.6 years for the same outcomes in the HSE.

16. The 2011 Census shows a spike in the density before the pension age for men and after the pension age for women, with this cohort inflated by the increase in the birthrate immediately following World War II. However, the should not affect the estimates, as outcomes are reported in proportions and the change in the birthrate did not happen discontinuously; McCrary tests report a p-value of 0.259 (McCrary 2008).

istics do not change across this threshold for either gender.

The secondary approach is nearly identical, but takes advantage of the panel structure of the longitudinal surveys. The fixed effects instrumental variables approach is the most common in recent literature, and similarly leverages a discrete change in retirement probability at an eligibility age.[17] This method includes individual fixed effects to account for time-invariant unobserved characteristics that are correlated with both retirement and health and time fixed effects to control for time-specific shocks in a given wave of a survey. However, controlling for time- and individual-level fixed effects do not account for negative health shocks that can induce retirement. The eligibility age is then used to instrument for retirement. For this to be a valid instrument, it must be correlated with retirement probability and affect health only through the act of retirement. The first assumption is easily verified with the first stage equation as follows:

$$R_{it} = \gamma_0 + \gamma_1 Z_{it} + \boldsymbol{Age}_{it} + \eta_t + \rho_i + \varepsilon_{it} \tag{3}$$

where R_{it} is individual i's retirement status in time t, Z_{it} is the set of instruments, $\boldsymbol{Age}_{it}$ are flexible controls for age, η_t is a time fixed effect, and ρ_i is an individual fixed effect. The predicted values are then used in the reduced form equation.

$$H_{it} = \delta_0 + \delta_1 \hat{R}_{it} + \boldsymbol{Age}_{it} + \eta_t + \rho_i + \varepsilon_{it} \tag{4}$$

Because discrete age thresholds should not affect health status directly, it is unlikely that this instrument can affect health outcomes through channels other than retirement. This is particularly true in England, where this age threshold is not associated with a change in

17. For example, Bonsang, Adam, and Perelman (2012), Coe et al. (2012), and Gorry, Gorry, and Slavov (2016) all use this approach.

health insurance coverage as it is in the U.S.

While both methods yield similar results, the advantage of the RD approach is to effectively pool survey participants by age group, allowing for more precise estimates and an abstraction away from issues with survey attrition. I can also pool across datasets when questions are sufficiently similar to further increase precision.[18] However, the FE-IV approach does allow for multiple thresholds to be examined in other scenarios, such as the sharp changes in retirement probability in the United States at both ages 62 and 65.

4 Results

This paper comprehensively examines the changes an individual may experience upon leaving the labor force. I first establish the first stage effect of the pension age on retirement. Next, I show results on individuals' self-reported health. I explore these results by then examining the effect of retirement on health behavior, the effect of retirement on health outcomes and utilization, and the effect of the retirement on mortality. I then provide estimates for individuals without higher education, for whom effect sizes might be larger due to a higher proportion in physically-demanding occupations. Finally, I compare my results to those found in prior studies.

4.1 First Stage: Retirement at the Pension Age

First, I examine the proportion of workers that exit the labor force at the State Pension Age. Figures 1a and 1b give the age profiles for men and women, respectively, of retirement status centered around their respective state pension age from the 2011 England and Wales Census. Across genders there is a sharp and marked increase in the proportion of individ-

18. Some outcomes are elicited in each of the ELSA, BHPS, and HSE. In these cases, I first standardize the outcomes within data source and then stack the data from these sources. See Anderson 2008 for a justification of this approach.

uals retired, although the change is noticeably larger for men. Table 2 gives the complementary point estimates along with estimates from other data sources, with standard errors clustered by age in the RD estimates and by individual in the FE-IV regressions.[19] The proportion of men retired increases by about 20 percentage points according to the census, and increases by about 10 percentage points for women from the same data source. Because these estimates are generated from the entire population, these are the preferred estimates, and subsequent tables show two-stage least squares (2SLS) using this as the first stage and standard errors calculated via the delta method. Estimates from the BHPS, HSE, and ELSA are higher, and FE-IV estimates shown in Panel (B) give similar estimates. As expected, the state pension age strongly predicts the probability of retirement.[20]

It is possible that any relationship between retirement and health may simply be an income effect. Without being supplemented by any other income source, it would be difficult to live using only the state pension payments, and retirement would mark a sharp drop in purchasing ability for individuals that attempt to do so. As such, most households have savings and/or private pensions as supplementary or primary income sources in the retirement years, with the state pension expected to contribute 36 percent of the average retiree's income.[21] Table B1 shows evidence of this by providing estimates of the effect of reaching the state pension age on income and wealth. These estimates are from a FE-IV regression using two waves of the Wealth and Assets survey. This shows that total income is decreased, but household wealth is unaffected, at least in the short term.[22]

19. RD figures for these estimates are shown in Figure B1

20. The estimates vary across data source in part because of the differences in the way the questions are asked to those being surveyed. The exact question are as follows. 2011 Census: "Last week, were you: retired (whether receiving a pension or not)" (check box). HSE: "Which of these descriptions applies to what you were doing last week, that is in the seven days ending (date last Sunday)", with "Retired from paid work" as one of the options. ELSA: "which of these, would you say, best describes your situation", with cards shown for labor force statuses. BHPS: "Please look at this card and tell me which best describes your current situation", with "Retired from paid work altogether" as an option.

21. From Prudential's Class of 2015 retirement study (https://www.pru.co.uk/pdf/press-centre/expected-retirement-income.pdf)

22. These data do not provide exact ages, so "short term" in this case is 1-4 years after the pension age.

It is also possible that this finding is because only a subset of the population retires at the age threshold, while the vast majority begin taking a pension (see Figures B1(a) and B1(b)). This could mean that those that do not retire see a sizable change in income, and any health effects can be attributed to this income boost. For those that do not retire, shown in Table B2, pension income increases significantly, and the value of household wealth decreases. But, net income does not change signficantly, and when pension wealth is taken out of household wealth, there is no longer a statistically significant change in wealth. This suggest that this sub-population may begin collecting the pension and working less while not retiring outright, and that their wealth is being decreased by the expected amount as they draw on their pension. Together, this would indicate any health effects of retirement are not simply due to lost or gained income, and cannot be compared to health effects of becoming unemployed or having a spouse lose their job.[23]

4.2 Self-Reported Health

Figures 2 and G3 and Table 3 show the effects of retirement on self-reported health. Self-reported health has consistently been found to be an accurate predictor of future health outcomes and utilization (Idler and Benyamini 1997), and I am able to provide estimates of this measure with far greater precision than any previous work by using the 2001 and 2011 Censuses of England and Wales. I split the analysis of the 2001 and 2011 Censuses for two reasons. First, the wording of the question changed slightly, and the 2011 Census includes 5 possible options instead of 3.[24] Second, the threshold is at a different age for

23. See for example Gallo et al. 2000

24. In the 2001 Census, the question was: "Over the last twelve months would you say your health on the whole has been:". The check box options are "good", "fairly good", and "not good". In the 2011 Census the question is "How is your health in general?", and the options are "very good", "good", "fair", "bad", and "very bad". I aggregate "very good" and "good" as well as "bad" and "very bad" to make estimates more comparable. While the change in possible categories does not affect the estimates of the changes at the retirement age, it does affect the levels at all ages. This is discussed thoroughly in Smith and White (2009).

women in 2001 (age 60) than it is for women in 2011 (age 61.5).

The effect of retirement on self-reported health for men, shown in Figure 2 and odd numbered columns of Table 3, is estimated to be small but significant and concentrated among those reporting bad or very bad health. There is an 11 percent drop in the proportion of men reporting this status in the 2001 census (2.3 percentage points), and a 2.5 percent drop in the 2011 census (0.3 percentage points). These changes are absorbed by the "good" category in 2001, and the "fair" category in 2011. Estimates from survey data sets mirror these results, with the coefficient estimate on the proportion of men reporting bad general health negative and even larger than the Census-based estimates. Further, the results also present in the FE-IV estimates shown in Table D3.

Changes to women self-reported health upon retirement is reported in Figure G3 and even numbered columns of Table 3. These indicate a drop in the proportion of women with bad or very bad general health of 6 percent and 4.5 percent from the 2001 and 2011 censuses, respectively (1 and 0.4 percentage points). The change is absorbed by increases to the proportion reporting good and fair in 2001, and an increase to good only in 2011. Results from survey data sets are mostly consistent, but not statistically significant, and FE-IV estimates in Table D3 show similar drops in the proportion of individual's reporting poor health. These results are consistent with previous work showing that the strongest effects of retirement are in "perceived health" (e.g. Johnston and Lee 2009), and that objective measures of health may be difficult to measure immediately (e.g. Gorry, Gorry, and Slavov 2016).

The Census also asks individuals if they have an long-term illness or disability that limits day-to-day activities. Figure G4 shows the age profiles of this question by gender for the 2011 and 2001 censuses, and point estimates are provided as the last set of estimates in Table 3. There is a significant drop in the proportion of men reporting having a long-term illness or disability in the 2001 census, and a significant drop for women in both 2001 and 2011. The effect size is largest for men in 2001 at about 7 percent, with women steady at about 2.5 percent in both decades. Results from the survey data sets are not significant although the question wordings vary. The exception is for men in the BHPS with the FE-IV specification, shown in Table D3.

Together, these results provide strong and robust evidence that retirement improves self-reported health, with effects particularly strong for those in poor health to begin with.

4.3 Health Outcomes

With individuals reporting substantially better health — particularly for with worse health overall — I next investigate if these effects induce changes to measurable health outcomes. Table 4 investigates how retirement affects mental health and cognitive ability for men and women. Columns (1)-(4) are tests of memory and cognitive ability, administered by the survey teams. "Depression score" is derived from the CES-D scale in the ELSA and the GHQ-12 questionnaire in the BHPS and HSE, and is constructed by standardizing scores from each test before combining and re-standardizing. For both men and women, there is no significant change in any of these related outcomes. These results are perhaps expected, as it is unlikely to have immediate impacts on mental health and cognition upon retiring. In FE-IV estimates — with a lag between retirement and the time of the survey — show that men improve across all measures of mental health.

Panel (A) of Tables 5 and 6 shows estimates to changes in health problems and health indicators for men and women, respectively. Column (1) is a standardized measure of whether the respondent has health issues that affects daily activities such as dressing and bathing. *Health Prob. Index* in column (2) aggregates the number of health problems respondents list, and *Any Health Prob.* is a dummy variable indicating if the respondent lists any health problem. Blood pressure and pulse are measured by a nurse for respondents that agree to have their vital signs taken.

For men, there is some evidence that retirement decreases the number of health problems as well as the probability of having any health problems (columns (4) and (5)). Women do not see any significant changes in these outcomes. These results may be due to differences in environment after retiring, where an individual's physical capabilities may no longer be strained on a regular basis. However, objective measures provided by the HSE indicate that retirement reduces systolic blood pressure for women, and pulse for both sexes. There is evidence that hypertension and higher resting heart rates can be linked to stress.[25]

I examine the effect of retirement on healthcare utilization in Figure 5. This shows the regression discontinuity estimates of the change in admission counts for England from 1990-2010 by sex. The Table gives estimates with the dependent variable — counts of admissions — in log terms. The figures show that there is no statistically significant change in the number of admissions at the State Pension Age, either for elective (day) or emergency (ordinary) admissions. Further evidence of this is in Figure D1, which gives robustness to bandwidth choice. This shows that the changes to inpatient admissions are too sensitive to bandwidth to infer that admissions are changing in a substantive manner.[26]

Further examination of changes to utilization is given in in Panel (B) of Tables 5 and 6. For men, there is no change in the probability of being admitted to the hospital, the

25. See Chida and Steptoe (2010) for a meta-analysis of this literature.

26. Day admissions for women show an increase for women for larger bandwidth choices. This is likely due to the cessation of NHS invitations for cervical exams at age 64, as well as breast cancer screening that goes out to 62 year olds. These together produce a notable drop in these planned day case admissions around age 63.

number of doctor visits, going to the dentist, having an eye exam, or having a blood test. For women, there is a small but statistically significant decrease in the number of annual visits to a general practitioner. Together, this indicates that there is little evidence that retirement affects individuals' use of medical services.

4.4 Mortality

With individuals reporting better health and fewer long-term ailments, it seems unlikely that retirement could affect mortality in a negative way. Figures 6 and 7 show this to be true. Figure 6 shows the age profiles of mortality separately for men and women with month-of-birth cohort bins relative to the respective state pension ages. Neither sex shows a significant discontinuity at the threshold, and Figure 7 gives regression discontinuity estimates by bandwidth to confirm this; for all causes of death, there is only one statistically significant estimate across sexes for any bandwidth under 5 years.[27]

Table 7 gives complementary point estimates as well as a heterogeneity analysis by cause of death. This includes 7 broad categories of death — categorized using ICD-9 and ICD-10 codes — as well as an "other" category that includes all other causes not specifically listed. For men, shown in Panel (a), there is a significant increase in the number of cancer- and diabetes-related deaths at the age of 65. For women, shown in Panel (b), there is a significant decrease in mortalities caused by the respiratory system. However, these results are not robust to small variations in choices of bandwidth, as shown in Figure 7. These results indicate that there is no effect of retirement on mortality.

27. This result is also not robust to a "donut" style RD where the spike at the month of the 65th birthday is controlled for in the regression model.

4.5 Health Behavior

With only minor changes in key health outcomes and no changes in mortality, I next investigate if the significant changes to self-reported health may be driven by health-related behaviors and changes to individuals' day-to-day environment. Panel (A) of Tables 8 and 9 shows estimates for drinking, smoking, and exercising by gender. While there is some evidence that women are less likely to exercise frequently upon retiring, there is no statistically significant change in smoking or drinking rates for men or women. This is perhaps to be expected, as these habits are unlikely to begin or cease completely in short periods of time for individuals in their 60s. Instead, columns (5) and (6) examines intensity measures; namely, number of days per week an individual consumes alcohol and a cigarette intensity measure that classifies individuals into non-smokers (0 cigarettes per day), light smokers (1-10 per day), moderate smokers (11-20 per day), or heavy smokers (20+ per day). Here, men do not show an change in either category, but women report drinking less frequently.

Panel (B) of these tables refers to changes in the frequency and quality of social interaction. Column (1) reports estimates of a standardized and combined measure of whether individuals see their friends, children, and/or relatives on a weekly basis. Men are slightly less likely to see their friends and family, while there are no changes for women. Men are also more likely to go out to eat regularly. Men see a significant increase in self-reported life satisfaction, with the question asked on a sliding scale from "completely unsatisfied" to "completely satisfied". There is no statistically significant change in any category for women. Further, neither sex shows a significant change in the average age of their closest friend. FE-IV estimates do report substantial increases in individuals' satisfaction with their social lives and life satisfaction for both genders (Column B6 of Tables C1 and C2).

Panel (C) reports changes in time use from the BHPS, reported in terms of minutes per day. Columns (1)-(4) — representing work, housework, sleeping, and leisure — are mutually exclusive, and columns (5) and (6) divides leisure into passive and social leisure, respectively. Passive leisure represents activities usually undertaken alone, while social leisure includes activities that usually involves meeting or interacting with other people.[28] As expected, there is a significant decrease in the amount of time working, with the decrease larger for men. These estimates show that the time is substituted into leisure and sleeping, with both genders showing an increase in these categories. Furthermore, the increase in leisure represents over half of the time substitution for both genders, and more of this time goes toward passive leisure.

4.6 Heterogeneity and Complier Characteristics

It might be the case that different types of workers are more sensitive to government-instituted age thresholds for public pensions. In the United States, for example, it has been shown that blue-collar workers with more demanding jobs are far more likely to claim social security early, and those with managerial or professional jobs are less likely (Public Affairs 2014). With this in mind, I present estimates for individuals without any post-secondary education in Tables 10 and 11 for men and women, respectively. Panel (a) shows first stage results for the probability of being retired and the change in income and assets. Estimates for this group are higher than the overall population, with estimates roughly 1.5 times larger for both men and women. This indicates that they are more likely to leave the labor force upon reaching the state pension age. Similar to the larger population, there is no evidence of significant change in household income.

28. Passive leisure includes eating at home, media consumption, and computer use. Active leisure includes outings, eating and drinking out, sports, hobbies, and friend visits.

Panel (b) gives estimates for health behavior. Men do not change their drinking, smoking, or exercise habits upon retirement, but they are less likely to see their friends and children on a weekly basis. Women do not see any changes in health behavior.

Finally, Panel (c) shows estimates for healthcare utilization and outcomes. Both men and women without higher education show no change in utilization of services, and men are less likely to report having any health problem. Similar to the main results, there is no evidence that retirement affects mental health in this population. Perhaps surprisingly, effects on self-reported health are only slightly higher than for the general population. This suggests that it is not simply the cessation of physically-demanding, blue-collar labor that is driving the improvements in health. While this segment of the population is certainly affected strongly, combining these estimates with the larger first stage estimates would indicate that workers without higher education are somewhat less likely to experience an improvement in health upon retirement.

I also examine the characteristics of the compliers, i.e. those that are induced to retire by reaching the State Pension Age. While the individual compliers cannot be identified with the RD approach, I back out the average characteristics of the complier group using the methods outlined in Almond and Doyle (2011) with results shown in Table 12. In line with results above, both male and female compliers are less likely to have education beyond high school than always- and never-takers. Further, compliers are far less likely to be married, here defined as currently married or cohabitating. Complier men are more likely to be single or divorced and have fewer children, indicating they are less likely to be family providers at that point in their lives. For women, less than 10 percent are married among the complier group. Intuitively, this is likely because many women wait for their husband to retire, even though they begin receiving the pension up to five years sooner.

5 Conclusion

This paper discusses the link between retirement and health, which is a well-studied relationship. Unlike previous papers, however, this paper traces out the chain of possible effects of reaching the conventional retirement age on a homogeneous population. To this end, it is important to compare estimates obtained here to those in the existing literature. Figure 8 gives estimates and confidence intervals from multiple studies for several outcomes included in the main results of this paper. It is important to note that included authors and estimates are not a judgement of quality or importance; rather, these are outcomes that are derived from sources that are sufficiently comparable to outcomes in my data sources. The weakness of this comparison, of course, is that potentially important estimates are left out if not directly comparable. The most notable instance is with Weemes Grøtting and Lillebø (2018), who find similar results to this paper in self-reported health, utilization, and mortality.

Estimates in Figure 8 are for men only, unless otherwise noted. For author estimates, RD estimates are rescaled by the first stage from the 2011 census, with standard errors computed via the delta method. Units are specific to each panel. In the top left panel for "bad" overall health, I take a weighted average of my estimates from the 2001 and 2011 Census.

My estimates are more precise than those found in previous literature. From this, it seems relatively clear that pension ages and early retirement incentives have a substantial effect on retirement, retirement reduces the proportion of people that report poor health, and retirement does not affect inpatient admissions. The major exception is in mortality for men, with results unable to match those of Fitzpatrick and Moore (2016).

The results presented here point to several clear implications about the relationship between retirement and health. First, it is clear that the state pension age affects retirement decisions, with a significant portion of the population aligning retirement with that threshold. Second, retirement substantially improves individuals' self-reported health, especially for those on the lower end of the spectrum. Individuals are also less likely to report having long-term ailments, and men report fewer health problems while women have lower measured blood pressures. Both sexes have lower pulse rates, and sleep and take more leisure upon retirement. Sleep deprivation in particular is associated with higher blood pressure and pulse rates (Lusardi et al. (1996)), as well as increased hypertension (Gottlieb et al. (2006)). As such, results suggest retirement improves health stocks through lower stress, an interpretation supported by a substantial literature on the relationship between long-term stress and health. Third, there is little consistent evidence that retirement affects health behaviors, such as smoking, drinking, exercising, and socializing. Fourth, there is similarly limited evidence on the effect of retirement on cognition and mental health. Finally, congruent to these findings, retirement does not appear to significantly impact healthcare utilization and mortality.

The primary limitation of this work relates to external validity. While this paper utilizes a very large and comprehensive set of data sources, it can not be ruled out that effects may differ in other countries and cultures. However, governments considering increasing the retirement age should be aware that this would impact individuals' health and well-being.

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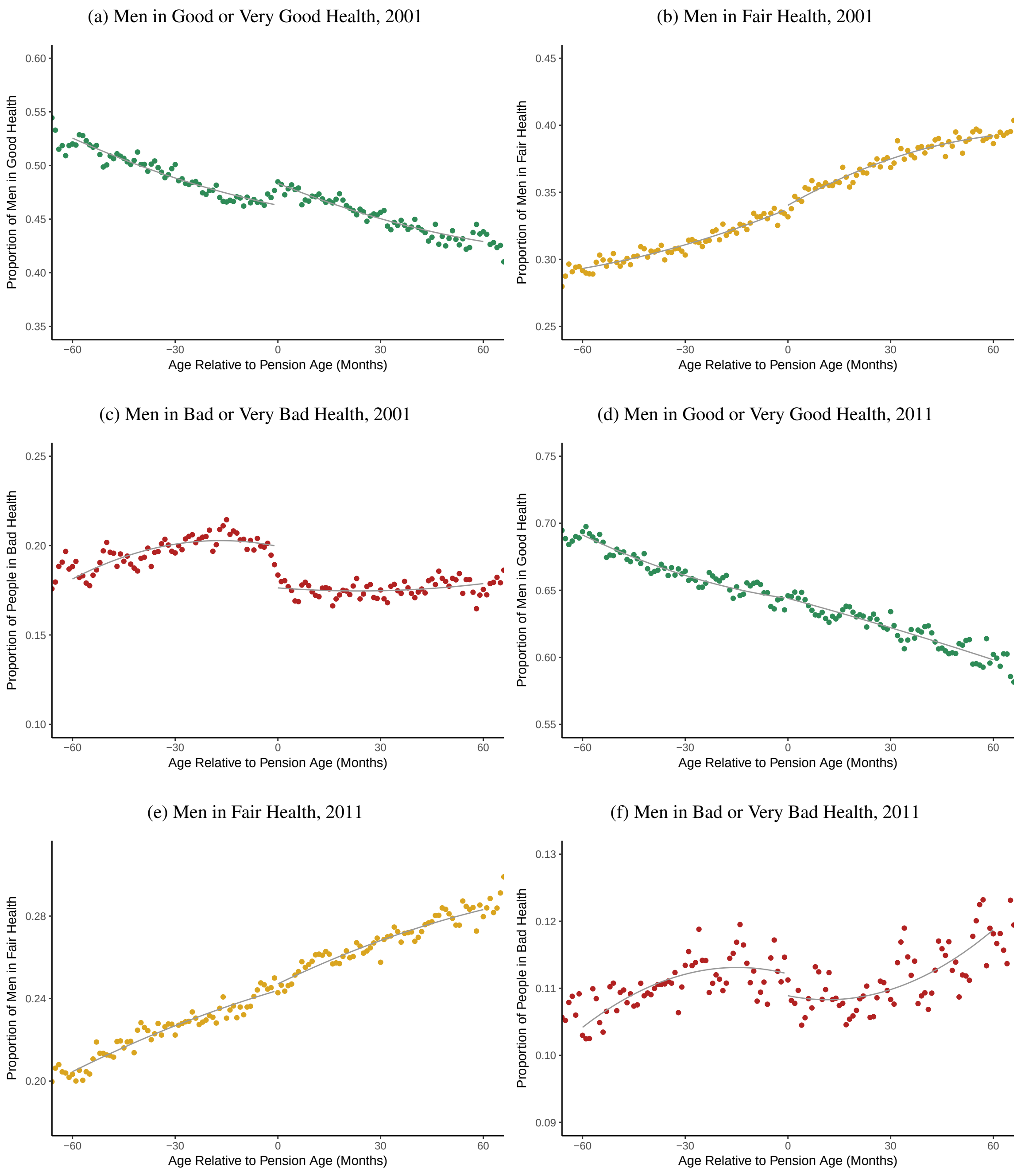
Figure 1: Age Profile of Retirement Status from 2011 Census

(a)

(b)

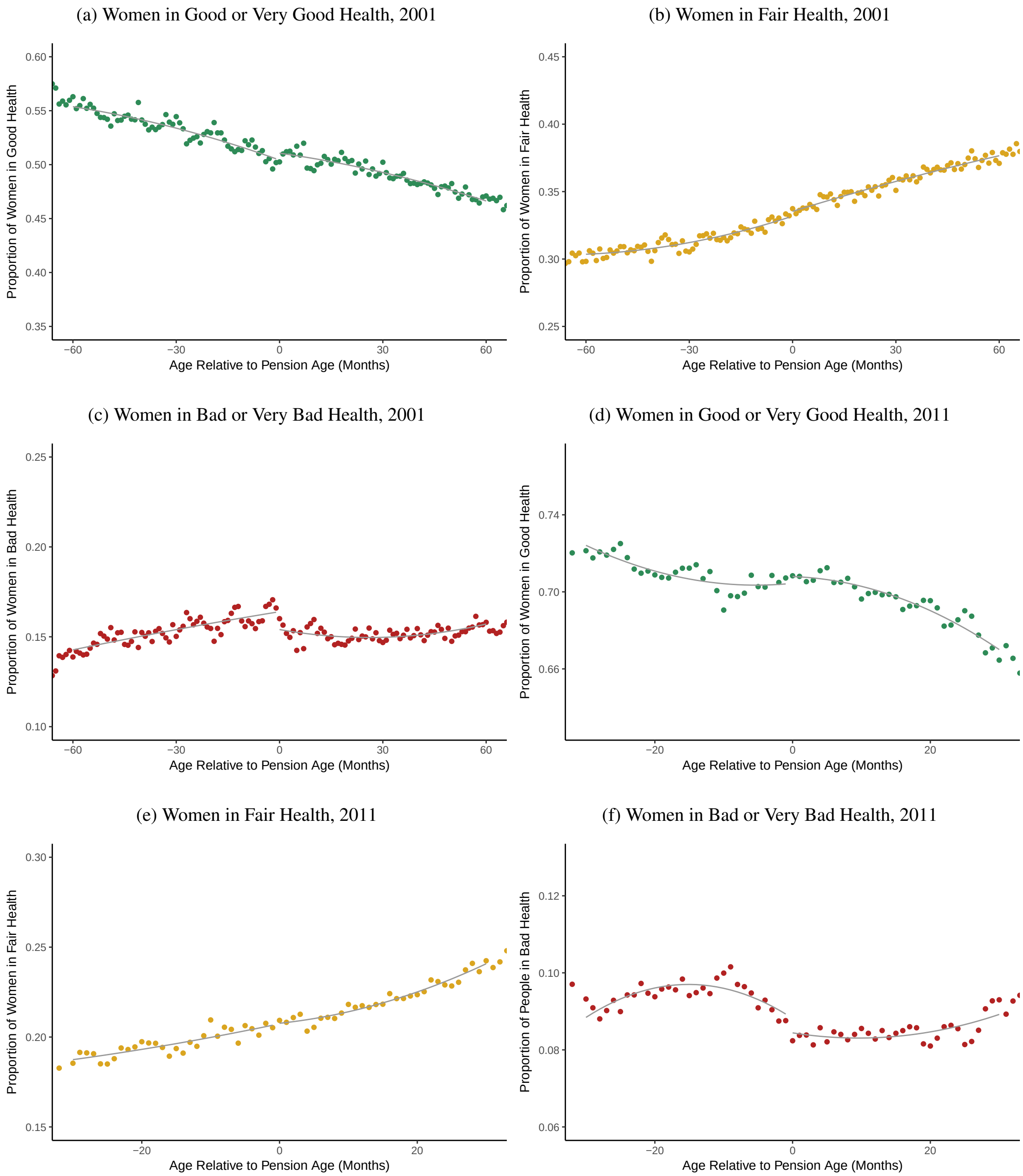
Notes: Retirement status by age in bins by gender from the 2011 England and Wales Census. Each point is a proportion of total respondents that fall in that particular age bin (1 month for men, 2 months for women). The figure is centered around the State Pension Age, which is 65 for men varies by month-of-birth cohort for women.

Figure 2: Age Profiles of Self-Reported Health from the 2001 and 2011 Censuses, Men



Notes: Proportion of the male population reporting good or very good health, fair health, or bad or very bad health, respectively, from the 2001 and 2011 England/Wales censuses. Each point is a proportion of total respondents that fall in that particular age month bin. The census question is: 'How is your health in general?'

Figure 3: Age Profiles of Self-Reported Health from the 2001 and 2011 Censuses, Women



(a) Women in Good or Very Good Health, 2001

(b) Women in Fair Health, 2001

(c) Women in Bad or Very Bad Health, 2001

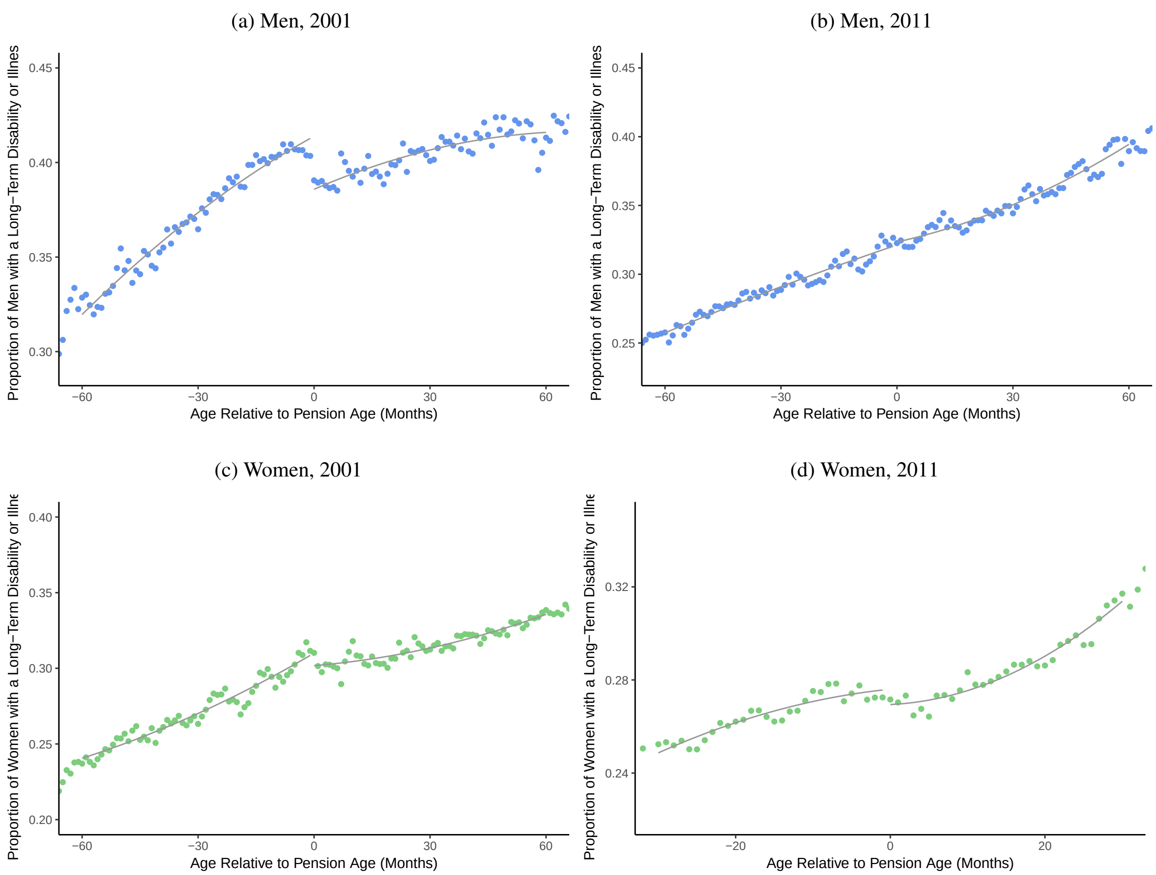
(d) Women in Good or Very Good Health, 2011

(e) Women in Fair Health, 2011

(f) Women in Bad or Very Bad Health, 2011

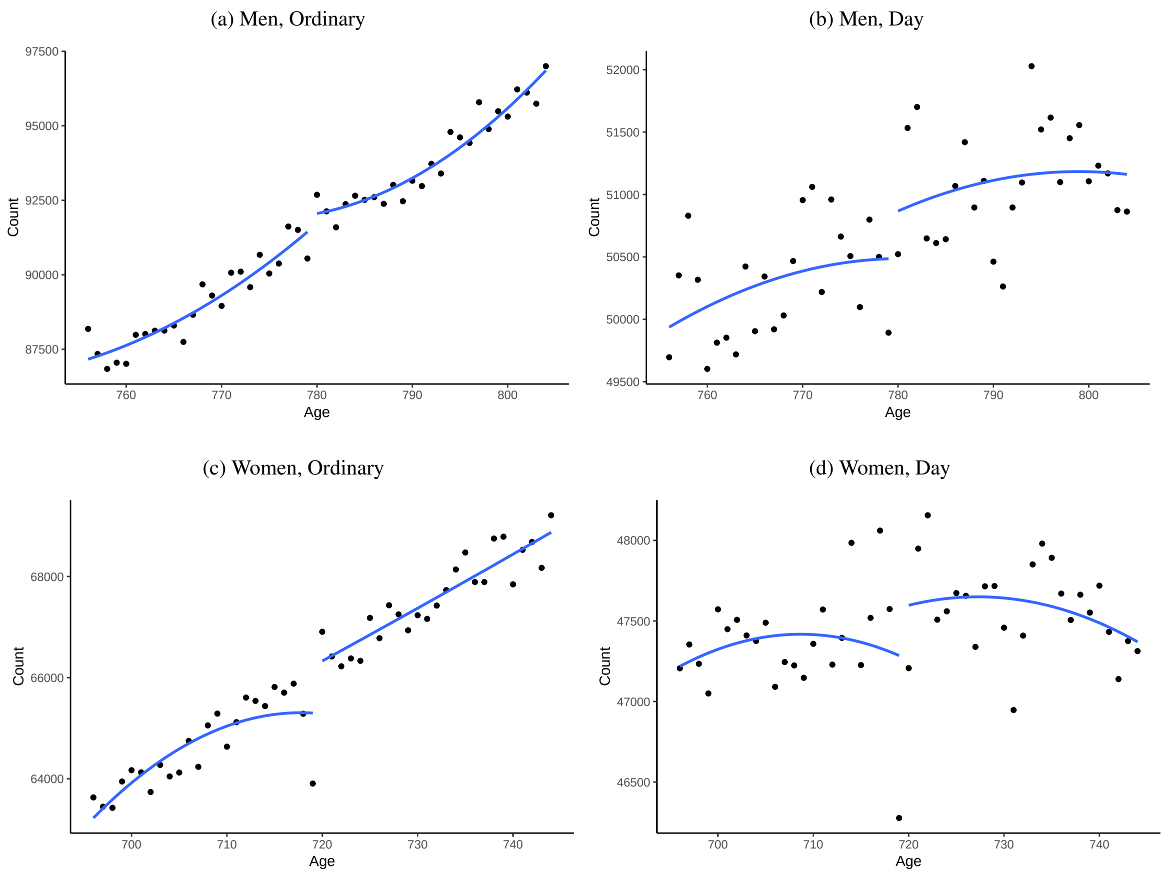
Notes: Proportion of the female population reporting good or very good health, fair health, or bad or very bad health, respectively, from the 2001 and 2011 England/Wales censuses. Each point is a proportion of total respondents that fall in that particular age bin (1 month for men in 2001 and 2011, 1 month for women in 2001, and 2 months for women in 2011). The census question is: 'How is your health in general?'

Figure 4: Age Profile of Long-Term Illness or Disability from 2001 and 2011 Census



Notes: Self-reported long-term illness or disability status by age in bins by gender from the 2001 and 2011 England and Wales Censuses. Each point is a proportion of total respondents that fall in that particular age bin (1 month for men in 2001 and 2011, 1 month for women in 2001, and 2 months for women in 2011). The figure is centered around the State Pension Age, which is 65 for men and varies by month-of-birth cohort for women. The census question is: 'Are your day-to-day activities limited because of a health problem or disability which has lasted, or is expected to last, at least 12 months?'

Figure 5: Inpatient Counts, 1990-2010

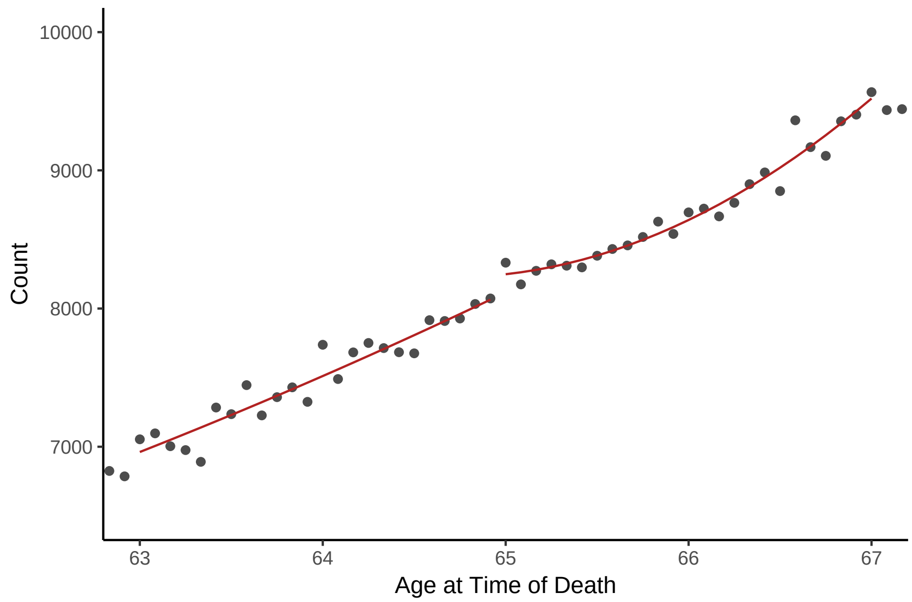


	All		Ordinary		Day	
	Men	Women	Men	Women	Men	Women
Change at State Pension Age	-0.002 (0.003)	-0.001 (0.003)	0.001 (0.004)	0.009 (0.007)	0.004 (0.006)	0.006 (0.008)

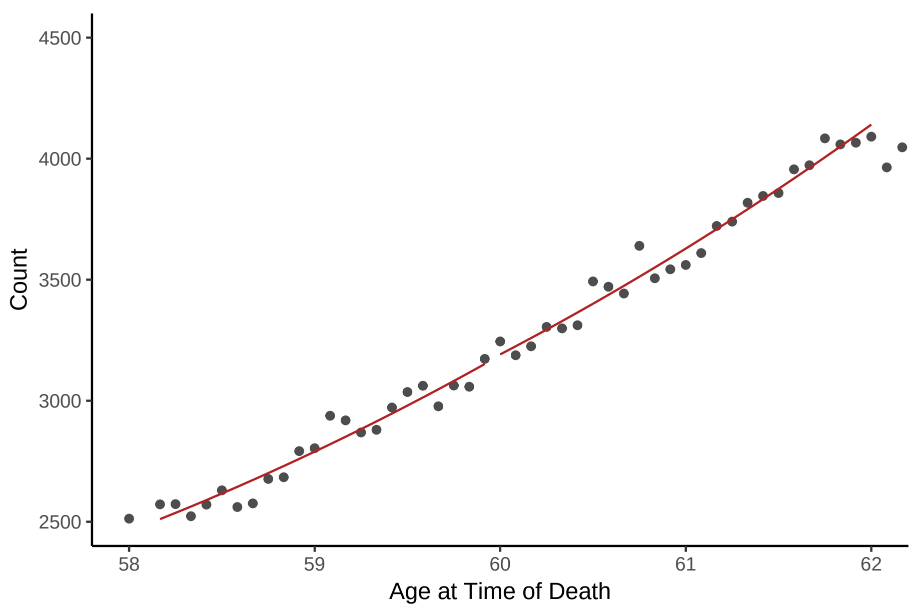
Notes: Regression discontinuity figures and estimates of reaching the State Pension Age on the count of inpatient admissions from the Hospital Episode Statistics (HES). The count of ordinary (emergency/unplanned) admissions for men is shown in (a), and the count of ordinary admissions for women is shown in (c). Subfigures (b) and (d) show the count of day case (elective/planned) admissions for men and women, respectively. Regression estimates are shown in the table below, with results for all admissions, ordinary admissions, and day case admissions by sex. The dependent variable is the log of inpatient counts for England from 1990-2010. Standard errors in parenthesis.

Figure 6: Mortality Age Profiles, England 1990-2011

(a) Men

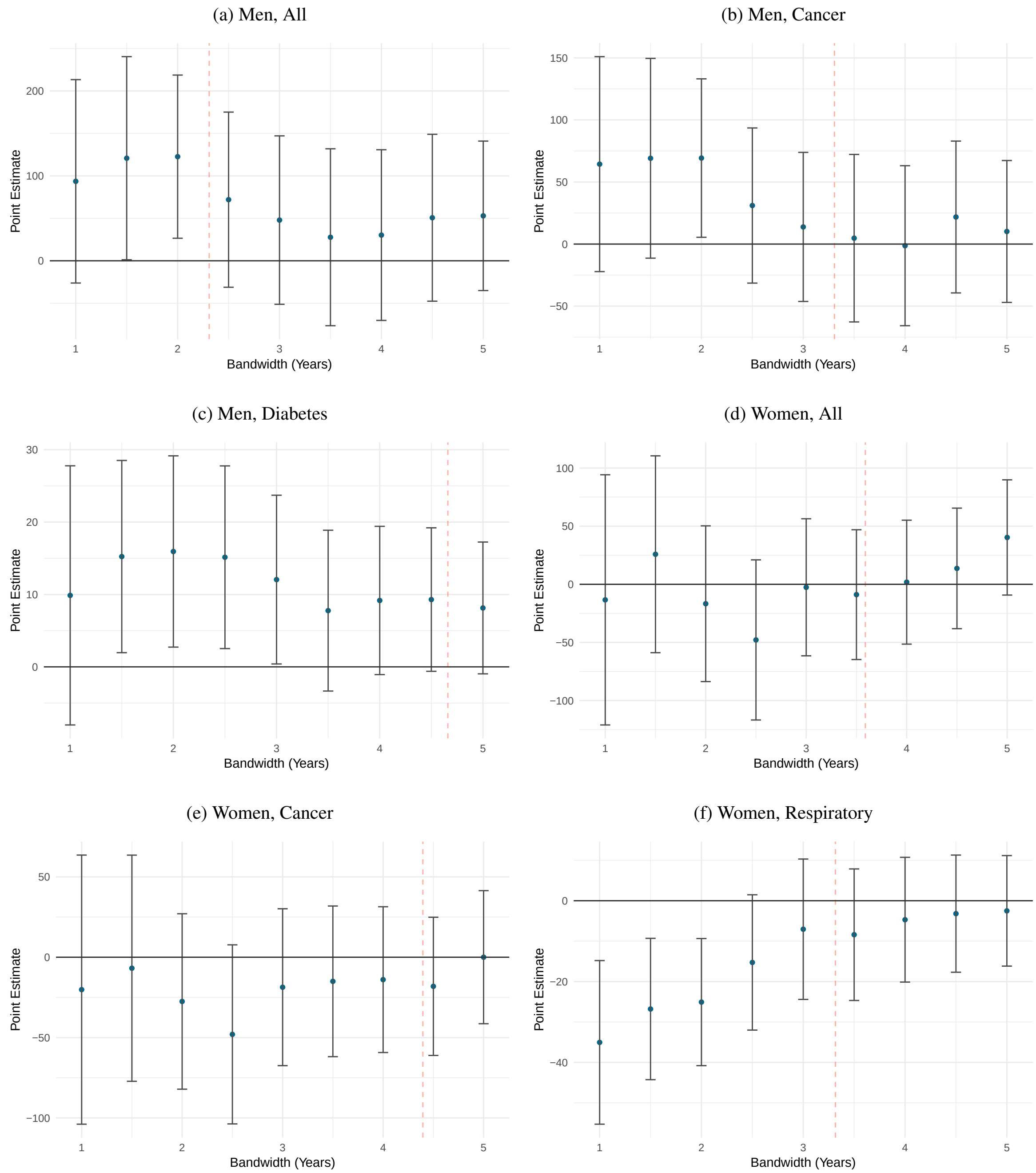


(b) Women



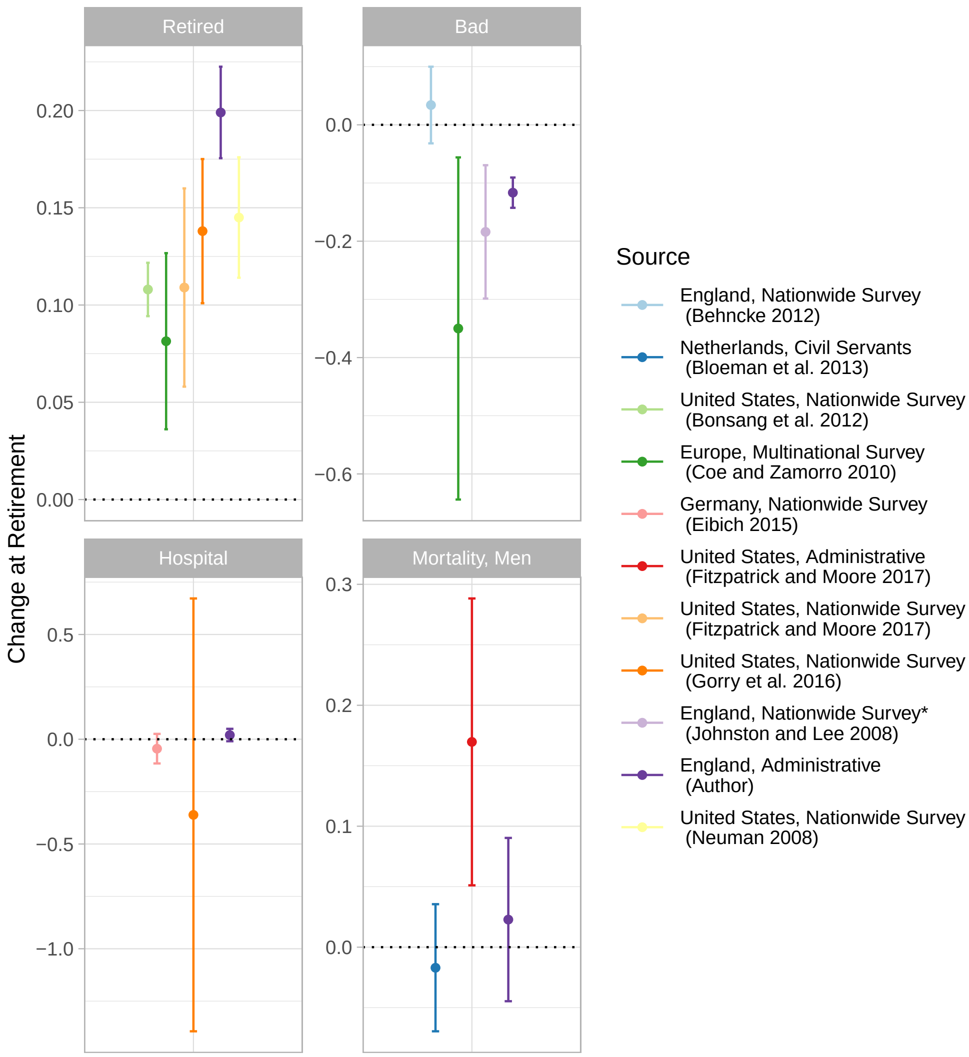
Notes: Age profiles of mortality by gender from England from 1990-2011. Each point is a count of the number of individuals in that month-of-birth cohort that died relative to the State Pension Age.

Figure 7: Robustness of Mortality RD Estimates, England 1990-2011



Notes: Regression discontinuity robustness of bandwidth choice for mortality by gender. Each point is a separate regression discontinuity point estimate with 95 percent confidence interval bars of the effect of reaching the State Pension Age on mortality counts. The vertical dashed line is the optimal bandwidth as estimated by the procedure developed by Calonico, Cattaneo, and Titiunik (2014).

Figure 8: Comparison to Previous Results



Notes: Author estimates of the effect of retirement compared to previous results from the literature. Each point is shown with a 95 percent confidence interval. The outcome variable is listed above each panel with an independent y-scale, and is for men only unless otherwise specified. Author RD estimates are rescaled by the first stage from the 2011 Census to make them comparable to IV studies, with the standard errors computed via the delta method. This is also done for estimates from Fitzpatrick and Moore (2017) and Bloemen, Hochguertel, and Zweerink (2017). *This study used a nationwide survey, but dropped individuals with a university degree.

Table 1: Data Sources

Data Source	Years	Type	Type	Use	Notes
Census	2001 & 2011	Administrative	Cross-Sectional	Retirement status, self-reported health	Aggregated to month-of-birth cohort level
Inpatient	1990-2010	Administative	Cross-Sectional	Inpatient admissions	Aggregated to month-of-birth cohort level
Mortality	1990-2011	Administative	Cross-Sectional	Mortality records	Aggregated to month-of-birth cohort level
English Longitudinal Survey on Aging (ELSA)	2002-2013	Survey	Panel	Retirement status, health behaviors, health outcomes	Age given in years
British Houshold Panel Survey (BHPS)	1991-2009	Survey	Panel	Retirement status, health behaviors, health outcomes	Age given in months
Health Survey for England (HSE)	2000-2009	Survey	Cross-Sectional	Retirement status, health behaviors, health outcomes	Age given in years
England Labour Force Survey	1992-2001	Survey	Cross-Sectional	Retirement status	
Wealth and Assets Survey	2006-2012	Survey	Panel	Household assets and income	

Notes: Overview of data sources used. See text for additional information.

Table 2: Effect of State Pension Age on Retirement Status

(a) Regression Discontinuity

	Retired (1)	Retired (2)	Retired (3)	Retired (4)	Retired (5)	Retired (6)	Retired (7)	Retired (8)	Retired (9)	Retired (10)
State Pension Age	0.301***	0.222***	0.272***	0.301***	0.199***	0.163***	0.199***	0.200***	0.215***	0.104***
	(0.019)	(0.016)	(0.036)	(0.012)	(0.012)	(0.010)	(0.021)	(0.026)	(0.021)	(0.011)
Constant	0.435	0.536	0.452	0.443	0.419	0.266	0.227	0.258	0.218	0.371
Dataset	HSE	ELSA	BHPS	BHPS,HSE & ELSA	2011 Census	HSE	ELSA	BHPS	BHPS,HSE & ELSA	2011 Census
Gender	Men	Men	Men	Men	Men	Women	Women	Women	Women	Women
Observations	13,454	18,083	12,185	27,695	121	16,442	21,515	16,180	35,825	61
Adjusted R^2	0.470	0.449	0.265	0.259	0.998	0.396	0.406	0.246	0.232	0.998

(b) FE-IV

	Retired (1)	Retired (2)	Retired (3)	Retired (4)
State Pension Age	0.310***	0.264***	0.273***	0.197***
	(0.0136)	(0.0273)	(0.0114)	(0.0231)
Dataset	ELSA	BHPS	ELSA	BHPS
Gender	Men	Men	Women	Women
Observations (n)	18,083	46,729	21,515	56,098
Individuals (i)	5,849	6,575	6,857	7,716

Notes: First stage estimates of reaching the State Pension Age on whether an individual is retired. Panel (A) gives regression discontinuity estimates, and Panel (B) provides FE-IV estimates from the longitudinal data sources. For the estimates from the 2011 census, the State Pension Age was in transition for women in 2011 and was set to 61.5; in the remaining columns the State Pension Age is 65 for men and 60 for women. * significant at ¡ 10%, ** significant at 5%, *** significant at 1%.

Table 3: Regression Discontinuity Models on Self-Reported Health

	2011 Census		2001 Census		BHPS,ELSA,HSE	
	(1)	(2)	(3)	(4)	(5)	(6)
Good	0.000	0.004	0.020***	0.006*	0.041*	0.070
	(0.003)	(0.002)	(0.003)	(0.003)	(0.023)	(0.045)
	0.644	*0.704*	*0.463*	*0.504*	*−0.179*	*−0.137*
Fair	0.003	0.000	0.003	0.004**	0.033	−0.019
	(0.002)	(0.002)	(0.003)	(0.002)	(0.042)	(0.041)
	0.244	*0.207*	*0.338*	*0.332*	*0.059*	*0.059*
Bad	−0.003**	−0.004**	−0.023***	−0.010***	−0.069**	−0.051
	(0.002)	(0.002)	(0.003)	(0.003)	(0.035)	(0.043)
	0.112	*0.088*	*0.200*	*0.164*	*0.106*	*0.089*
Long Illness/Disability	0.002	−0.007***	−0.028***	−0.008***	−0.034	−0.026
	(0.003)	(0.003)	(0.003)	(0.003)	(0.031)	(0.023)
	0.321	*0.276*	*0.414*	*0.310*	*0.255*	*0.130*
Gender	Men	Women	Men	Women	Men	Women
Observations	121	61	121	121	26,954	34,754
2SLS (Bad)	-0.02 (0.01)	-0.02 (0.01)	-0.12 (0.02)	-0.05 (0.01)	-0.34 (0.18)	-0.26 (0.22)

Notes: Regression discontinuity estimates of reaching the State Pension Age on self-reported health and long-term illnesses and disabilities. *Good*, *Fair*, and *Bad* are outcome variables split from a single question asking the individual about their general health. "Good" means the individual indicated "Very Good" or "Good", and "Bad" means the individual indicated "Bad" or "Very Bad". *Long Illness/Disability* asks the individual if they have a long-term illness or disability. For estimates from the 2011 Census, the State Pension Age is in transition for women in the 2011 and is 61.5; in the other columns the State Pension Age is 65 for men and 60 for women. 2SLS estimates for *Bad* shown using 2011 Census results as the first stage. Estimates just before the threshold are listed in italics just below the standard errors. * significant at 10%, ** significant at 5%, *** significant at 1%

Table 4: Regression Discontinuity Models on Cognition and Mental Health Outcomes

(a) Men

	Orient Date	Recall Score	Memory Score	Verbal Score	Depression Score
	(1)	(2)	(3)	(4)	(5)
State Pension Age	0.026	0.009	−0.014	0.037	−0.058
	(0.034)	(0.022)	(0.042)	(0.057)	(0.051)
Constant	0.006	−0.031	0.074	0.051	−0.103
Dataset	ELSA	ELSA	ELSA	ELSA	ELSA,HSE,BHPS
Observations	17,986	18,000	14,812	14,884	22,806
2SLS	0.13 (0.17)	0.05 (0.11)	-0.07 (0.21)	0.18 (0.29)	-0.29 (0.25)

(b) Women

	Orient Date	Recall Score	Memory Score	Verbal Score	Depression Score
	(1)	(2)	(3)	(4)	(5)
State Pension Age	−0.013	−0.009	−0.013	0.000	−0.062**
	(0.018)	(0.006)	(0.014)	(0.065)	(0.034)
Constant	−0.001	0.060	3.869	11.761	0.120
	(0.018)	(0.005)	(0.013)	(0.054)	(0.024)
Dataset	ELSA	ELSA	ELSA	ELSA	ELSA,HSE,BHPS
Observations	21,431	21,442	17,824	17,895	30,340
2SLS	-0.07 (0.13)	-0.05 (0.09)	-0.06 (0.11)	0 (0.11)	-0.31 (0.13)

Notes: Regression discontinuity estimates of reaching the State Pension Age on mental health outcomes. *Orient Date* indicates if the respondent was able to name the date. *Recall Score* is a sum of immediate and delayed word recall tests. *Memory Score* is a test of how well an individual can remember previously given instructions, with partial credit up to a score of 4 for performing the task as instructed.*Verbal Score* asks respondents to name as many animals as they can in one minute, with the score being the number of acceptable answers. *Depression Score* is a standardized score from the 8-item Centre of Epidemiological Studies Depression (CES-D) scale and the GHQ-12 questionnaire, where a higher value indicates a higher likelihood of minor psychiatric disorders. 2SLS estimates use 2011 Census results as the first stage. * significant at 10%, ** significant at 5%, *** significant at 1%.

Table 5: Regression Discontinuity Models on Health Outcomes, Men

(a) Health Problems and Indicators

	Limits to Daily Activity	Health Prob. Index	Any Health Prob	Systolic BP	Diastolic BP	Pulse
	(1)	(2)	(3)	(4)	(5)	(6)
State Pension Age	0.026	-0.116^{*}	-0.051^{*}	-0.897	-0.135	-1.881^{***}
	(0.063)	(0.069)	(0.029)	(1.393)	(0.769)	(0.478)
Constant	-0.185	1.660	0.474	149.058	83.034	69.625
Dataset	ELSA & BHPS	BHPS	BHPS	BHPS	HSE	HSE
Observations	19,445	12,014	12,014	3,264	3,264	3,274
2SLS	0.13 (0.32)	-0.58 (0.35)	-0.26 (0.15)	-4.51 (7)	-9.45 (2.47)	-0.68 (3.86)

(b) Utilization

	GP	Dentist	Eye Exam	Blood Test	Cholesterol
	(1)	(2)	(3)	(4)	(5)
State Pension Age	-0.020	0.019	0.028	-0.017	-0.014
	(0.058)	(0.021)	(0.027)	(0.026)	(0.032)
Constant	2.650	0.559	0.439	0.633	0.376
	(0.047)	(0.018)	(0.017)	(0.021)	(0.027)
Dataset	BHPS	BHPS	BHPS	BHPS	BHPS
Observations	11,518	11,525	11,525	11,525	11,525
2SLS	-0.1 (0.29)	0.09 (0.11)	0.14 (0.13)	-0.09 (0.13)	-0.07 (0.16)

Notes: Regression discontinuity estimates of reaching the State Pension Age on health outcomes for men. *Limits to Daily Activity* indicates if health limits daily activities such as walking and dressing. *Health Prob. Index* is an index created by simply summing the number of health issues individuals indicated, and *Any Health Prob* is a dummy variable if the individual indicated at least one health issue. Under panel (b), all variables indicate if the individual has utilized that service in the previous 12 months with the exception of *GP*, which is number of visits in the previous 12 months. 2SLS estimates use 2011 Census results as the first stage. * significant at 10%, ** significant at 5%, *** significant at 1%

Table 6: Regression Discontinuity Models on Health Outcomes, Women

(a) Health Problems and Indicators

	Limits to Daily Activity	Health Prob. Index	Any Health Prob	Systolic BP	Diastolic BP	Pulse
	(1)	(2)	(3)	(4)	(5)	(6)
State Pension Age	0.039	−0.024	0.005	-3.994^{***}	−0.104	-1.487^{***}
	(0.050)	(0.071)	(0.022)	(1.028)	(0.765)	(0.421)
Constant	−0.193	1.670	0.459	146.425	76.813	72.479
Dataset	ELSA & BHPS	BHPS	BHPS	BHPS	HSE	HSE
Observations	25,610	15,922	15,922	4,119	4,119	4,131
2SLS	0.2 (0.25)	-0.12 (0.36)	0.03 (0.11)	-20.07 (5.31)	-7.47 (2.16)	-0.52 (3.85)

(b) Utilization

	GP	Dentist	Eye Exam	Blood Test	Cholesterol
	(1)	(2)	(3)	(4)	(5)
State Pension Age	-0.081^{***}	−0.001	0.013	−0.012	−0.024
	(0.023)	(0.020)	(0.024)	(0.022)	(0.017)
Constant	2.718	0.641	0.460	0.561	0.273
Dataset	BHPS	BHPS	BHPS	BHPS	BHPS
Observations	15,556	15,574	15,574	15,574	15,574
2SLS	-0.41 (0.37)	-0.01 (0.1)	0.06 (0.12)	-0.06 (0.11)	-0.12 (0.09)

Notes: Regression discontinuity estimates of reaching the State Pension Age on health outcomes for women. *Limits to Daily Activity* indicates if health limits daily activities such as walking and dressing. *Health Prob. Index* is an index created by simply summing the number of health issues individuals indicated, and *Any Health Prob* is a dummy variable if the individual indicated at least one health issue. Under panel (b), all variables indicate if the individual has utilized that service in the previous 12 months with the exception of *GP*, which is number of visits in the previous 12 months. 2SLS estimates use 2011 Census results as the first stage. * significant at 10%, ** significant at 5%, *** significant at 1%

Table 7: Regression Discontinuity Models on Mortality

(a) Men

	Cause of Death								
	All Causes	Cancer	Infectious	Respiratory	Vascular	Diabetes	Mental	Injuries	Other
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
State Pension Age	131.435**	65.909*	−1.497	16.916	32.603	17.044**	0.318	−6.591	5.641
	(55.105)	(37.448)	(8.694)	(15.007)	(27.991)	(8.088)	(4.476)	(6.333)	(25.764)
Constant	8,116.768	3,194.333	65.729	520.581	3,231.244	81.163	20.405	88.058	910.193
Observations	49	49	49	49	49	49	49	49	49
Adjusted R^2	0.981	0.947	0.055	0.895	0.975	0.578	0.634	0.296	0.802

(b) Women

	Cause of Death								
	All Causes	Cancer	Infectious	Respiratory	Vascular	Diabetes	Mental	Injuries	Other
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
State Pension Age	3.955	−10.705	7.674	−23.476***	12.265	4.779	1.038	0.207	13.240
	(38.542)	(33.207)	(5.413)	(8.830)	(21.007)	(3.876)	(1.935)	(4.130)	(18.231)
Constant	3,187.412	1,659.975	29.819	199.427	742.922	39.289	8.129	44.086	457.959
Observations	49	49	49	49	49	49	49	49	49
Adjusted R^2	0.988	0.964	0.366	0.939	0.957	0.547	0.308	0.199	0.870

Notes: Regression discontinuity estimates of reaching the State Pension Age on mortality. The “other” category is a catch-all that includes all other subcauses not explicitly listed. * significant at 10%, ** significant at 5%, *** significant at 1%.

Table 8: Regression Discontinuity Models on Health Behavior, Men

(a) Self Care

	Smokes	Inside Smoke	Drinks	Exercise	# of Drinking Days/Week	Cigarette Intensity
	(1)	(2)	(3)	(4)	(5)	(6)
State Pension Age	−0.006	0.004	0.020	0.002	−0.072	−0.003
	(0.038)	(0.023)	(0.017)	(0.041)	(0.095)	(0.039)
Constant	−0.141	0.204	0.111	0.035	3.150	0.344
Dataset	BHPS,HSE,ELSA	HSE	ELSA,HSE	BHPS,HSE,ELSA	ELSA	HSE
2SLS	-0.02 (0.11)	0.02 (0.12)	-0.04 (0.08)	0.14 (0.11)	0.13 (0.17)	-0.01 (0.2)
Observations	26,241	13,470	16,118	17,882	13,191	13,510

(b) Friends and Family

	See Friends & Family Weekly	Eat Out	Meaningful Friendships	Social Satisfaction	Life Satisfaction	Age of Closest Friend
	(1)	(2)	(3)	(4)	(5)	(6)
State Pension Age	-0.111^{***}	0.149^{***}	−0.006	0.070	0.141^{**}	1.187
	(0.017)	(0.049)	(0.053)	(0.063)	(0.065)	(0.947)
Constant	−0.014	0.415	−0.105	0.186	0.094	56.213
Dataset	ELSA	BHPS	HSE	BHPS	BHPS	BHPS
2SLS	-0.56 (0.09)	0.75 (0.25)	-0.03 (0.27)	0.35 (0.32)	0.71 (0.33)	5.96 (4.77)
Observations	22,117	4,979	8,719	8,633	8,627	5,384

(c) Time Use

	Work	Routine Housework	Other Domestic Work	Sleep	Leisure	Passive Leisure	Social Leisure
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
State Pension Age	-29.085^{***}	−1.163	3.873^{**}	9.924^{***}	16.451^{***}	10.001^{***}	6.450^{***}
	(8.093)	(1.703)	(1.756)	(2.748)	(4.014)	(3.108)	(2.214)
Constant	156.290	52.292	123.387	612.984	495.043	338.771	156.271
Dataset	BHPS	BHPS	BHPS	BHPS	BHPS	BHPS	BHPS
2SLS	-146.16 (41.61)	-5.84 (8.56)	19.46 (8.9)	49.87 (14.13)	82.67 (20.78)	50.26 (15.91)	32.41 (11.3)
Observations	5,406	5,406	5,406	5,406	5,406	5,406	5,406

Notes: Regression discontinuity estimates of reaching the State Pension Age on functional outcomes for men. *Smokes* is if the individual currently smokes. *Inside Smoke* measures if anyone in the household smokes indoors. *Exercise* refers to frequent (once per week) activity. *See Friends & Family Weekly* is a standardized measure of whether respondents have weekly contact with their friends, family, or children. *Meaningful Friendships* is a standardized measure capturing if respondents report having friends that care about them and can be relied on. *Social Satisfaction* and *Life Satisfaction* are standardized scores of measures of individuals' satisfaction with their social lives and life overall, respectively. Time use outcomes are denominated in minutes, where columns (1)-(5) are mutually exclusive and exhaustive. *Social Leisure* includes leisure activities involving meeting or talking with people and *Passive Leisure* includes leisure activities usually done alone or are not usually conducive to establishing social networks. 2SLS estimates use 2011 Census results as the first stage. *significant at 10%, ** significant at 5%, *** significant at 1%

Table 9: Regression Discontinuity Models on Health Behavior, Women

(a) Self Care

	Smokes	Inside Smoke	Drinks	Exercise	# of Drinking Days/Week	Cigarette Intensity
	(1)	(2)	(3)	(4)	(5)	(6)
State Pension Age	0.039	0.011	0.009	-0.081^{*}	-0.193^{***}	0.006
	(0.047)	(0.014)	(0.019)	(0.047)	(0.057)	(0.033)
Constant	−0.051	0.228	−0.007	0.039	2.340	0.389
Dataset	BHPS,HSE,ELSA	HSE	ELSA,HSE	BHPS,HSE,ELSA	ELSA	HSE
2SLS	-0.08 (0.18)	0.05 (0.07)	0.05 (0.1)	-0.08 (0.13)	-0.07 (0.13)	0.03 (0.16)
Observations	32,735	16,457	20,437	23,895	15,470	16,457

(b) Friends and Family

	See Friends & Family Weekly	Eat Out	Meaningful Friendships	Social Satisfaction	Life Satisfaction	Age of Closest Friend
	(1)	(2)	(3)	(4)	(5)	(6)
State Pension Age	−0.016	−0.048	0.049^{*}	−0.002	0.025	−0.646
	(0.016)	(0.041)	(0.029)	(0.044)	(0.062)	(0.822)
Constant	−0.037	0.527	0.056	0.137	0.113	54.173
Dataset	ELSA	BHPS	HSE	BHPS	BHPS	BHPS
2SLS	-0.08 (0.08)	-0.24 (0.21)	0.24 (0.15)	-0.01 (0.22)	0.12 (0.31)	-3.25 (4.13)
Observations	29,686	6,909	10,681	11,988	11,985	7,606

(c) Time Use

	Work	Routine Housework	Other Domestic Work	Sleep	Leisure	Passive Leisure	Social Leisure
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
State Pension Age	-17.120^{**}	1.974	2.342^{*}	4.266^{**}	8.538^{**}	4.917^{**}	3.621^{*}
	(7.313)	(1.666)	(1.258)	(2.071)	(3.783)	(2.406)	(2.148)
Constant	138.586	139.382	97.497	613.840	450.695	285.866	164.833
Dataset	BHPS	BHPS	BHPS	BHPS	BHPS	BHPS	BHPS
2SLS	-86.03 (37.11)	9.92 (8.39)	11.77 (6.36)	21.44 (10.49)	42.91 (19.19)	24.71 (12.18)	18.2 (10.85)
Observations	7,283	7,283	7,283	7,283	7,283	7,283	7,283

Notes: Regression discontinuity estimates of reaching the State Pension Age on functional outcomes for women. *Smokes* is if the individual currently smokes. *Inside Smoke* measures if anyone in the household smokes indoors. *Exercise* refers to frequent (once per week) activity. *See Friends & Family Weekly* is a standardized measure of whether respondents have weekly contact with their friends, family, or children. *Meaningful Friendships* is a standardized measure capturing if respondents report having friends that care about them and can be relied on. *Social Satisfaction* and *Life Satisfaction* are standardized scores of measures of individuals' satisfaction with their social lives and life overall, respectively. Time use outcomes are denominated in minutes, where columns (1)-(5) are mutually exclusive and exhaustive. *Social Leisure* includes leisure activities involving meeting or talking with people and *Passive Leisure* includes leisure activities usually done alone or are not usually conducive to establishing social networks. 2SLS estimates use 2011 Census results as the first stage. *significant at 10%, ** significant at 5%, *** significant at 1%

Table 10: Heterogeneity in the Effect of Retirement by Education for Men

(a) Retirement and Pensions

	Retired	Retired	Retired	Any Pension	Income Last Month	Income	HH Income
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
State Pension Age	0.324***	0.368***	0.294***	0.809***	115.528	−0.227	−0.001
	(0.013)	(0.023)	(0.019)	(0.075)	(96.771)	(0.353)	(0.018)
Constant	0.400	0.391	0.491	0.005	1,458.217	9.751	0.183
Dataset	2001 Census	HSE	ELSA	BHPS	BHPS	HSE	ELSA
Observations	121	8,293	7,139	6,799	6,799	6,553	7,138

(b) Health behavior

	Smokes	Drinks	Exercise	Days Drinking/Week	Cigarette Intensity	See Friends & Family Weekly	Social Satisfaction	Life Satisfaction
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
State Pension Age	0.004	−0.014	0.050	−0.368	−0.003	−0.063**	0.095	0.192*
	(0.021)	(0.029)	(0.059)	(0.276)	(0.052)	(0.027)	(0.152)	(0.100)
Constant	−0.052	0.089	−0.106	2.935	0.426	0.066	5.272	0.055
Dataset	BHPS,ELSA,HSE	BHPS,ELSA,HSE	BHPS,ELSA,HSE	ELSA	HSE	ELSA	BHPS	BHPS
Observations	13,177	7,286	8,098	4,984	8,352	8,421	4,670	4,663
Adjusted R^2	0.003	0.001	−0.000	0.002	0.020	0.000	0.007	0.012

(c) Health Outcomes

	Bad	Bad	Disabled/ Long-Term Illness	Hospital	GP	Depression Score	Limit Daily Activities	Any Health Problem	Pulse
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
State Pension Age	−0.026***	−0.034	−0.031***	0.022	0.009	−0.042	−0.006	−0.063*	−2.713***
	(0.003)	(0.071)	(0.003)	(0.034)	(0.042)	(0.069)	(0.126)	(0.033)	(0.729)
Constant	0.218	0.221	0.439	0.682	0.396	−0.009	−0.175	0.495	71.253
Dataset	2001 Census	BHPS,ELSA,HSE	2001 Census	BHPS	BHPS, ELSA,HSE	BHPS, ELSA,HSE	ELSA,BHPS	BHPS	HSE
Observations	121	13,576	121	5,869	9,896	11,830	9,406	6,795	2,070

Notes: Regression discontinuity estimates of reaching the State Pension Age for men without post-secondary education. * significant at 10%, ** significant at 5%, *** significant at 1%

Table 11: Heterogeneity in the Effect of Retirement by Education for Women

(a) Retirement and Pensions

	Retired	Retired	Retired	Any Pension	Income Last Month	Income	HH Income
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
State Pension Age	0.163***	0.151***	0.254***	0.681***	29.444	0.197	−0.009
	(0.008)	(0.011)	(0.020)	(0.063)	(88.274)	(0.289)	(0.014)
Constant	0.399	0.268	0.180	0.006	1,773.389	10.696	0.165
Dataset	2001 Census	HSE	ELSA	BHPS	BHPS	HSE	ELSA
Observations	121	10,569	9,874	10,208	10,208	8,255	9,872

(b) Health behavior

	Smokes	Drinks	Exercise	Days Drinking/Week	Cigarette Intensity	See Friends & Family Weekly	Social Satisfaction	Life Satisfaction
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
State Pension Age	−0.037	0.005	−0.026	−0.164	0.009	−0.019	0.028	0.042
	(0.053)	(0.024)	(0.055)	(0.068)	(0.058)	(0.039)	(0.094)	(0.074)
Constant	0.080	−0.099	−0.105	1.880	0.471	0.068	5.088	0.098
Dataset	BHPS,ELSA,HSE	BHPS,ELSA,HSE	BHPS,ELSA,HSE	ELSA	HSE	ELSA	BHPS	BHPS
Observations	17,812	9,796	11,975	6,805	10,595	12,831	7,392	7,392

(c) Health Outcomes

	Bad	Bad	Disabled/ Long-Term Illness	Hospital	GP	Depression Score	Limit Daily Activities	Any Health Problem	Pulse
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
State Pension Age	−0.011***	−0.046	−0.010***	0.059*	−0.032	−0.067	0.081	0.008	−1.245
	(0.003)	(0.071)	(0.003)	(0.032)	(0.034)	(0.044)	(0.107)	(0.021)	(1.351)
Constant	0.174	0.187	0.322	0.671	0.262	0.212	−0.244	0.486	72.449
Dataset	2001 Census	BHPS, ELSA,HSE	BHPS	BHPS	BHPS, ELSA,HSE	BHPS, ELSA,HSE	ELSA, BHPS	BHPS	HSE
Observations	121	19,071	121	8,753	14,154	17,317	13,918	10,203	2,680

Notes: Regression discontinuity estimates of reaching the State Pension Age for women without post-secondary education. * significant at 10%, ** significant at 5%, *** significant at 1%

Table 12: Complier Characteristics

	Compliers	Always-Takers	Never-Takers
	Men		
Married (%)	59.8	75.6	83.1
Higher Education (%)	36.6	49.2	55.2
Number of Children	0.88	1.21	1.36
	Women		
Married (%)	9.2	67.9	84.4
Higher Education (%)	31.2	46.8	51.2
Number of Children	1.76	1.21	1.06

Notes: Complier characteristics for compliers (those that retired at the State Pension Age), always-takers (those retired before the State Pension Age), and never-takers (those who continued to work after the State Pension Age). Data taken from BHPS, ELSA, and HSE.

A Summary Statistics

Table A1: Summary Statistics

British Household Panel Survey

	Men (All Ages)			Women (All Ages)			Men (55-75)			Women (55-75)		
Variables	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n
Expected Retirement Age	61	6.87	514	59.3	6.83	1047	62.1	5.16	236	59.8	6.12	393
Age Retired	61.2	5.8	2153	58.6	7.58	2934	59.9	5.42	1266	57.9	6.4	1740
Receive Pension	0.169	0.375	104744	0.239	0.427	125385	0.424	0.494	23741	0.646	0.478	28323
Overall Health (1-5)	2.11	0.928	103019	2.24	0.965	120243	2.33	0.976	23104	2.4	0.986	27070
Health Limits Activity	0.85	0.357	95766	0.811	0.392	111736	0.747	0.435	21314	0.725	0.446	24944
Limits Housework	0.166	0.372	25760	0.326	0.469	33637	0.216	0.412	7591	0.4	0.49	9496
Limits Stairs	0.335	0.663	25760	0.433	0.722	33637	0.504	0.77	7591	0.581	0.792	9496
Limits Dressing	0.171	0.622	25760	0.193	0.652	33637	0.233	0.72	7591	0.219	0.688	9496
Limits Walking	0.607	1.29	25760	0.681	1.34	33637	0.923	1.52	7591	0.85	1.45	9496
Hospital, Prev. Year	0.084	0.277	110193	0.126	0.332	128663	0.12	0.325	24798	0.114	0.318	28989
GP Visits, Prev. Year	2.18	1.14	103514	2.62	1.22	123575	2.54	1.22	23449	2.73	1.25	27874
Registered Disabled	0.0599	0.237	60504	0.055	0.228	69593	0.128	0.335	12345	0.0963	0.295	14258
Considers Self Disabled	0.106	0.308	49584	0.111	0.315	58930	0.177	0.382	12427	0.168	0.374	14700
Health Problem Index	0.999	1.26	108571	1.26	1.39	126926	1.58	1.42	24474	1.77	1.51	28570
Num. Health Problems	0.742	0.437	191396	0.767	0.423	201251	0.767	0.423	24714	0.799	0.4	28895
Exercise Weekly	0.114	0.318	188825	0.119	0.323	199302	0.208	0.406	24181	0.199	0.399	28483
Exercise Monthly	0.138	0.345	188825	0.146	0.353	199302	0.237	0.426	24181	0.226	0.419	28483
Exercise Never	1.35	2.22	42332	1.57	2.32	50725	1.71	2.37	10185	1.92	2.43	12130
Smokes Cigarettes	0.273	0.446	98290	0.259	0.438	117318	0.205	0.404	22136	0.214	0.41	26443
Wellness, Likert Scale	10.4	5.03	100164	11.8	5.66	119496	10.4	4.85	22553	11.7	5.43	26806
Wellness, Caseness Scale	1.57	2.67	100164	2.17	3.15	119496	1.39	2.61	22553	1.95	3.05	26806
Health Satisfaction	5.03	1.55	73183	4.9	1.64	87968	4.8	1.69	17669	4.72	1.75	21031
Health Index	-0.129	0.997	50546	0.11	0.99	59426	0.356	1.16	10141	0.378	1.09	11990

2001 Census of England and Wales

	Men (All Ages)			Women (All Ages)			Men (55-75)			Women (55-75)		
Variables	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n

Count	-	-	22622985	-	-	22622985	-	-	6952604	-	-	7259015

2011 Census of England and Wales

	Men (All Ages)			Women (All Ages)			Men (55-75)			Women (55-75)		
Variables	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n
Count	-	-	28016595	-	-	28016595	-	-	5581362	-	-	5869977

English Longitudinal Study of Ageing (ELSA)

	Men (All Ages)			Women (All Ages)			Men (55-75)			Women (55-75)		
Variables	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n
Self-Reported Health	2.8	1.13	21693	2.79	1.11	27763	2.77	1.12	15479	2.74	1.1	18299
Depression Score	1.22	1.8	25447	1.71	2.06	32650	1.16	1.76	17966	1.61	2.01	21159
Exercise	4	1.25	25645	4.22	1.17	32880	3.94	1.26	18080	4.15	1.2	21264
Drinks Alcohol	0.921	0.27	23092	0.854	0.353	29632	0.928	0.258	16508	0.867	0.339	19619
Smokes Cigarettes	0.707	0.455	25638	0.555	0.497	32881	0.702	0.457	18071	0.565	0.496	21267
Impaired Cognitive Test	0.0963	0.295	25513	0.0942	0.292	32736	0.0806	0.272	18000	0.0764	0.266	21192
Delayed Word Recall Score	4.28	2.05	25500	4.67	2.15	32722	4.47	1.95	17993	4.92	2	21184
Orientation to Date	3.74	0.563	25500	3.79	0.528	32707	3.77	0.506	17986	3.83	0.443	21173
Recall Summary Score	9.89	3.53	25512	10.6	3.7	32734	10.3	3.32	18000	11	3.41	21186
HH Monthly Consumption	2716	26766	14771	3586	32915	18683	3083	29579	10727	3296	31318	12694
Retired	0.539	0.499	25649	0.501	0.5	32887	0.522	0.5	18083	0.531	0.499	21270
Est. Chance to Live to 85	46.6	25.9	10979	52.7	25.5	14190	46.7	25.9	9236	52.9	25.6	10916
Prospective Memory Test	3.49	1.25	21008	3.52	1.21	26937	3.57	1.15	14812	3.62	1.07	17405
Verbal Fluency Score	20.6	6.77	21181	20.1	6.67	27219	21.1	6.61	14884	20.6	6.38	17492
Get Care From Family	0.346	0.476	10682	0.441	0.497	17136	0.316	0.465	7162	0.402	0.49	10887

England labor Force Survey

	Men (All Ages)			Women (All Ages)			Men (55-75)			Women (55-75)		
Variables	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n
Working Last Week	0.593	0.491	1902194	0.446	0.497	2114833	0.488	0.5	788822	0.464	0.499	906324
Work Limited by Health	0.328	0.469	83073	0.332	0.471	88545	0.452	0.498	34466	0.387	0.487	39412

Health Survey for England

	Men (All Ages)			Women (All Ages)			Men (55-75)			Women (55-75)		
Variables	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n
Retired	0.163	0.369	69015									
Drinks Alcohol	0.563	0.496	69015									
Takes Vitamins	0.168	0.373	54369									
Gone to Dentist	0.295	0.456	28962									
Long-term Illness	0.375	0.484	69015									
Smokes Cigarettes	0.159	0.365	69015									
Exercises	0.306	0.461	37602									
General Health	1.81	0.932	69015									
Grouped GHQ Score	0.409	1.9	31294									
Body Fat Group (of 3)	0.0807	1.53	18469									

Notes: Summary statistics by data source and age group.

B Additional First Stage Tables and Figures

Figure B1: Age Profiles of Reaching the State Retirement Age on Pensions and Retirement

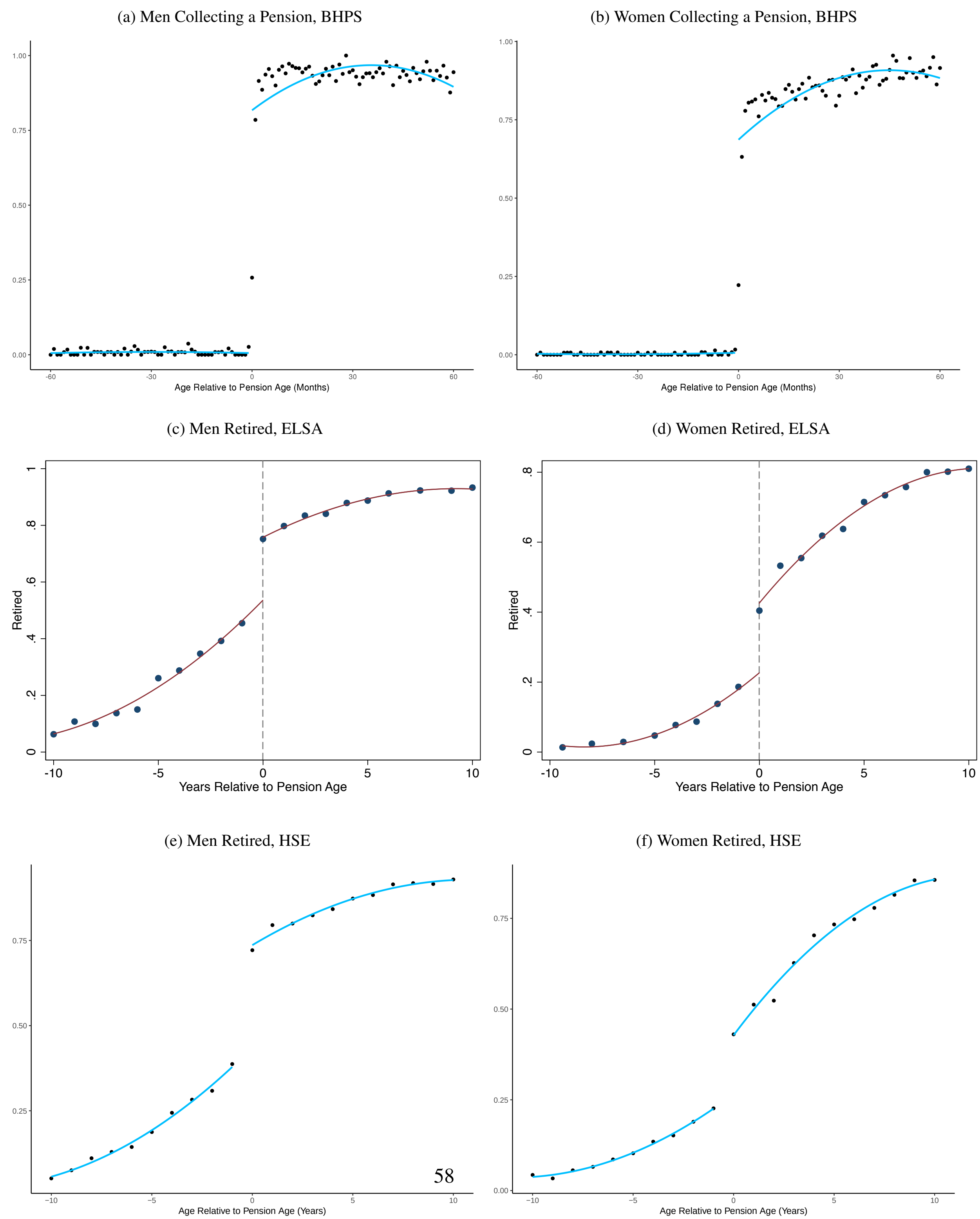


Table B1: Effect of State Retirement Age on Wealth, Wealth and Assets Survey

	Net Income (1)	Pension Income (2)	HH Wealth (3)	HH Wealth, No Pension (4)
State Pension Age	-10,520**	11,160***	-74,797	56,744
	(4,812)	(2,449)	(78,077)	(68,636)
Dataset	WAS	WAS	WAS	WAS
Observations (*n*)	4,168	4,168	42,595	42,595
Individuals (*i*)	2,084	2,084	18,940	18,940

Notes: Estimates of reaching the State Pension Age by household on income and wealth from the Wealth and Assets Survey. The State Pension Age is 65 for men and 60 for women, and estimates refer to when the household primary reference member reaches that age. Household wealth measures are windorized at the 5 percent level. * significant at 10%, ** significant at 5%, *** significant at 1%.

Table B2: Effect of State Retirement Age on Wealth for Non-Retiring Individuals, Wealth and Assets Survey

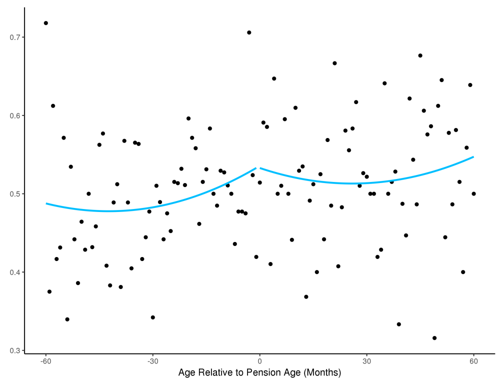
	(1)	(3)	(5)	(7)
VARIABLES	Net Income	Pension Income	HH Wealth	HH Wealth, No Pension
over65	8,092	6,368***	-31,125***	-4,244
	(10,683)	(972.9)	(12,031)	(7,304)
Dataset	WAS	WAS	WAS	WAS
Observations (*n*)	31,837	31,837	73,658	73,658
Individuals (*i*)	27,899	27,899	45,255	45,255

Notes: Estimates of reaching the State Pension Age by household on income and wealth from the Wealth and Assets Survey for household whose primary member is not retired in the survey wave after reaching the State Pension Age. The State Pension Age is 65 for men and 60 for women, and estimates refer to when the household primary reference member reaches that age. Household wealth measures are windorized at the 5 percent level. * significant at 10%, ** significant at 5%, *** significant at 1%

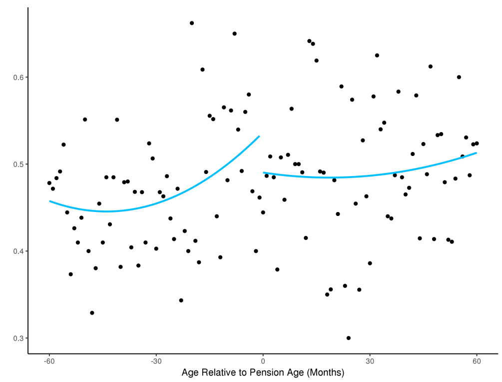
C Additional Tables and Figures on Health Behaviors

Figure C1: Age Profiles of Health Behaviors

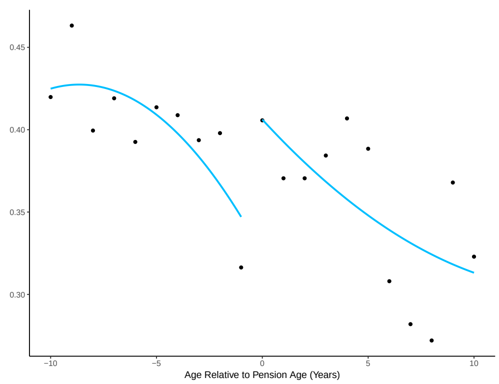
(a) Frequent Exercise for Men, BHPS



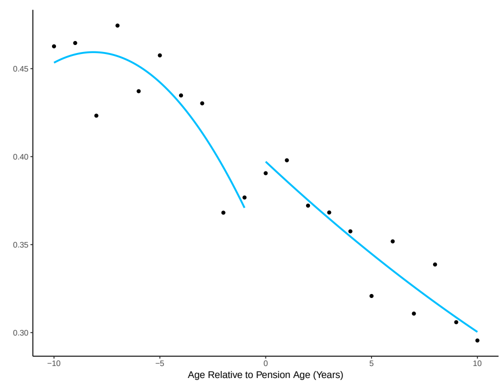
(b) Frequent Exercise for Women, BHPS



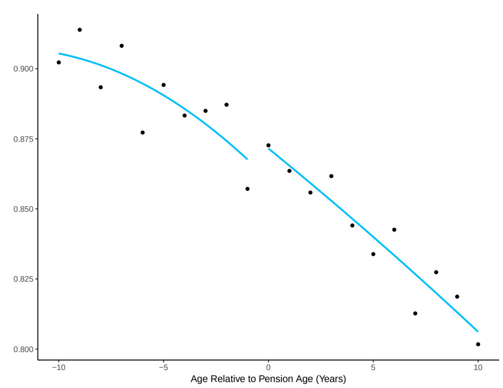
(c) Frequent Exercise for Men, HSE



(d) Frequent Exercise for Women, HSE



(e) Proportion of Men Drinking, HSE



(f) Proportion of Women Drinking, HSE

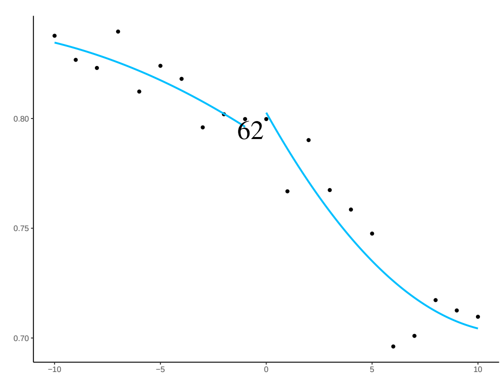


Table C1: FE-IV Estimates of the Effect of Retirement on Health Behaviors, Men

(a) Self-Care

	Smokes (1)	Smokes (2)	Drinks (3)	Exercise (4)	Exercise (5)
State Pension Age	0.00231	0.00812	0.0124	-0.183	-0.247**
	(0.0214)	(0.0112)	(0.0188)	(0.199)	(0.107)
Dataset	BHPS	ELSA	ELSA	BHPS	ELSA
Gender	Men	Men	Men	Men	Men
Observations (n)	40,677	16,628	14,969	18,080	16,645
Individuals (i)	5,333	4,406	4,118	4,274	4,413

(b) Friends and Family

	See Kids Weekly (1)	See Family Weekly (2)	See Friends Weekly (3)	See Friends (4)	Out to Eat (5)	Social Satisfaction (6)
State Pension Age	0.0850**	0.0704	0.0280	0.0135	0.0320	0.415***
	(0.0376)	(0.0460)	(0.0490)	(0.00831)	(0.0205)	(0.0952)
Dataset	ELSA	ELSA	ELSA	BHPS	BHPS	BHPS
Gender	Men	Men	Men	Men	Men	Men
Observations (n)	13,100	13,508	13,747	45,818	45,818	32,323
Individuals (i)	3,566	3,790	3,832	5,664	5,664	4,876

Notes: FE-IV estimates of reaching the State Pension Age on health behavior outcomes for men. *Smokes* is if the individual currently smokes in the BHPS, while the ELSA asks if they ever smoke. *Exercise* refers to frequent (once per week) activity. *Friends Care* signifies if the individual feels that is true (=2), partly true (=1), or not true (=0) that they have friends that would care for them if needed; *Rely* asks is the same scale for friends they can rely on. * significant at 10%, ** significant at 5%, *** significant at 1%.

Table C2: FE-IV Estimates of the Effect of Retirement on Health Behaviors, Women

(a) Self-Care

	Smokes (1)	Smokes (2)	Drinks (3)	Exercise (4)	Exercise (5)
State Pension Age	0.0188	-0.00670	0.00358	0.0824**	0.00368
	(0.0197)	(0.0107)	(0.0199)	(0.0385)	(0.103)
Dataset	BHPS	ELSA	ELSA	BHPS	ELSA
Gender	Women	Women	Women	Women	Women
Observations (n)	49,878	19,643	17,888	22,055	19,645
Individuals (i)	6,480	4,995	4,726	5,204	4,996

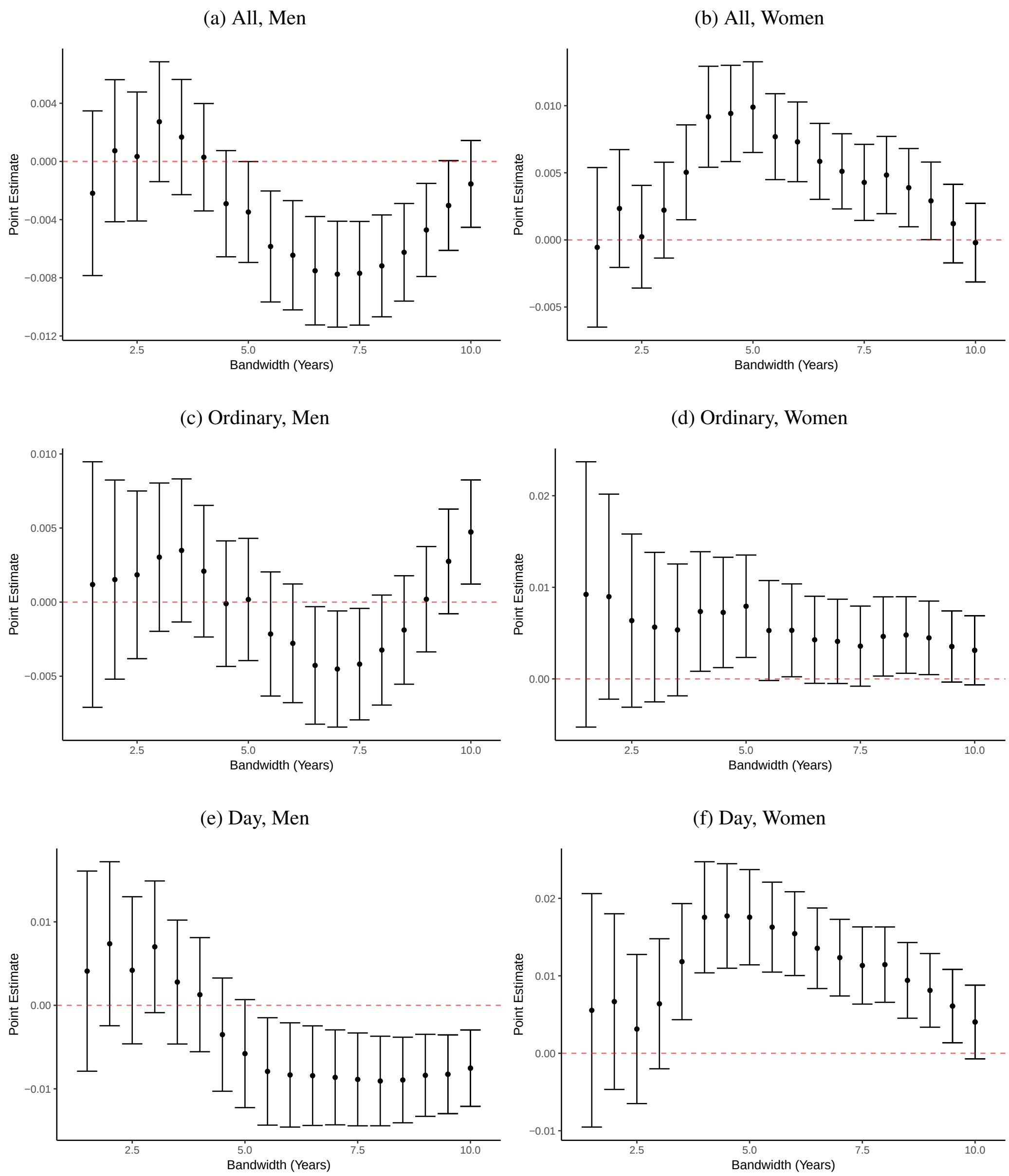
(b) Friends and Family

	See Kids Weekly (1)	See Family Weekly (2)	See Friends Weekly (3)	See Friends (4)	Out to Eat (5)	Social Satisfaction (6)
State Pension Age	0.0651*	0.142***	0.0590	0.0120	-0.00821	0.307***
	(0.0345)	(0.0423)	(0.0445)	(0.0104)	(0.0233)	(0.0821)
Dataset	ELSA	ELSA	ELSA	BHPS	BHPS	BHPS
Gender	Women	Women	Women	Women	Women	Women
Observations (n)	16,127	16,652	16,966	55,097	55,097	39,328
Individuals (i)	4,213	4,467	4,506	6,715	6,715	5,880

Notes: FE-IV estimates of reaching the State Pension Age on health behavior outcomes for women. *Smokes* is if the individual currently smokes in the BHPS, while the ELSA asks if they ever smoke. *Exercise* refers to frequent (once per week) activity. *Friends Care* signifies if the individual feels that is true (=2), partly true (=1), or not true (=0) that they have friends that would care for them if needed; *Rely* asks is the same scale for friends they can rely on. * significant at 10%, ** significant at 5%, *** significant at 1%

D Additional Tables and Figures on Health Outcomes

Figure D1: Inpatient Counts, Regression Discontinuity Robustness



Notes: Regression discontinuity robustness of bandwidth choice for inpatient counts by sex. Each point is a separate regression discontinuity point estimate with 95 percent confidence interval bars of the effect of reaching the State Pension Age on inpatient counts in logs.

Table D1: FE-IV Estimates of the Effect of Retirement on Mental Health

(a) Men

	Orient Date (1)	Recall Score (2)	Memory Score (3)	Verbal Score (4)	Life Satisfaction (5)	Depression Score (6)	Likert (7)	Caseness (8)
State Pension Age	-0.0284	0.268	0.112	0.252	0.572***	-0.407**	-0.453	0.0565
	(0.0401)	(0.254)	(0.0980)	(0.514)	(0.0808)	(0.159)	(0.969)	(0.547)
Dataset	ELSA	ELSA	ELSA	ELSA	BHPS	ELSA	BHPS	BHPS
Gender	Men	Men	Men	Men	Men	Men	Men	Men
Observations (n)	19,572	19,582	16,382	16,461	32,271	19,546	41,334	43,102
Individuals (i)	4,981	4,981	4,825	4,840	4,876	4,974	5,254	5,362

(b) Women

	Orient Date (1)	Recall Score (2)	Memory Score (3)	Verbal Score (4)	Life Satisfaction (5)	Depression Score (6)	Likert (7)	Caseness (8)
State Pension Age	-0.0284	0.268	0.112	0.252	0.382***	-0.407**	-1.829***	-0.813***
	(0.0401)	(0.254)	(0.0980)	(0.514)	(0.0732)	(0.159)	(0.360)	(0.203)
Dataset	ELSA	ELSA	ELSA	ELSA	BHPS	ELSA	BHPS	BHPS
Gender	Women	Women	Women	Women	Women	Women	Women	Women
Observations (n)	19,572	19,582	16,382	16,461	39,331	19,546	50,487	50,487
Individuals (i)	4,981	4,981	4,825	4,840	5,873	4,974	6,359	6,359

Notes: FE-IV estimates of reaching the State Pension Age on mental health outcomes.*Orient Date* indicates if the respondent was able to name the date. *Recall Score* is a sum of immediate and delayed word recall tests. *Memory Score* is a test of how well an individual can remember previously given instructions, with partial credit up to a score of 4 for performing the task as instructed.*Verbal Score* asks respondents to name as many animals as they can in one minute, with the score being the number of acceptable answers. *Depression Score* is from the 8-item Centre of Epidemiological Studies Depression (CES-D) scale. The *Likert* and *Caseness* scores are different codings of responses from the GHQ-12 questionnaire, in which a higher value indicates a higher likelihood of minor psychiatric disorders. * significant at 10%, ** significant at 5%, *** significant at 1%.

Table D2: FE-IV Estimates of the Effect of Retirement on Health Outcomes

(a) Men

	Limit Motor Ability (1)	Limit Daily (2)	Limit Daily (3)	Health Prob. Index (4)	Any Health Problem (5)	GP (6)	Dentist (7)	Eye Exam (8)	Cholesterol (9)
State Pension Age	-0.207**	-0.0847	-0.0476	-0.168	-0.0274	-0.358	0.0312	0.166	-0.0370
	(0.0952)	(0.0879)	(0.104)	(0.275)	(0.0246)	(0.295)	(0.0996)	(0.145)	(0.128)
Dataset	ELSA	ELSA	BHPS	BHPS	BPHS	BHPS	BPHS	BHPS	BHPS
Gender	Men	Men	Men	Men	Men	Men	Men	Men	Men
Observations (*n*)	12,600	12,600	39,287	45,818	45,818	43,102	43,132	43,132	43,132
Individuals (*i*)	3,729	3,729	5,556	5,664	5,664	5,362	5,362	5,362	5,362

(b) Women

	Limit Motor Ability (1)	Limit Daily (2)	Limit Daily (3)	Health Prob. Index (4)	Any Health Problem (5)	GP (6)	Dentist (7)	Eye Exam (8)	Cholesterol (9)
State Pension Age	-0.227**	-0.137	-0.0949***	-0.188**	-0.0186	-0.156*	0.0263	-0.0127	-0.0204
	(0.0955)	(0.0908)	(0.0273)	(0.0774)	(0.0277)	(0.0798)	(0.0272)	(0.0339)	(0.0344)
Dataset	ELSA	ELSA	BHPS	BHPS	BPHS	BHPS	BPHS	BHPS	BHPS
Gender	Men	Men	Women	Women	Women	Women	Women	Women	Women
Observations (*n*)	14,107	14,107	47,321	55,097	55,097	52,646	52,726	52,726	52,726
Individuals (*i*)	4,113	4,113	6,615	6,667	6,715	6,497	6,501	6,501	6,501

Notes: FE-IV estimates of reaching the State Pension Age on health outcomes. *Limit Motor Ability* indicates if health limits motor ability. *Limit Daily* measures if health limits daily activities. *Health Prob. Index* is an index created by simply summing the number of health issues individuals indicated, and *Any Health Prob* is a dummy variable if the individual indicated at least one health issue. Outcomes *Hospital*, *Dentist*, *Eye Exam*, and *Cholesterol* indicate if the individual has utilized that service in the previous 12 months, while *GP* is number of visits in the previous 12 months. * significant at 10%, ** significant at 5%, *** significant at 1%.

Table D3: FE-IV Effects of Retirement on Self-Reported Health

	BHPS		ELSA	
	(1)	(2)	(3)	(4)
Good	0.246**	0.0927***	-0.0129	-0.0147
	(0.115)	(0.0306)	(0.0438)	(0.0429)
Fair	-0.188*	0.00654	0.106**	0.0677
	(0.110)	(0.0292)	(0.0450)	(0.0428)
Bad	-0.193*	-0.0576*	-0.0458	-0.107***
	(0.113)	(0.0301)	(0.0345)	(0.0330)
Long/Illness Disability	-0.00503	-0.0136		
	(0.106)	(0.0283)		
Gender	Men	Women	Men	Women
Observations (*n*)	45,818	55,097	16,648	19,654
Individuals (*i*)	5,664	6,715	4,414	4,996

Notes: FE-IV estimates of reaching the State Pension Age on self-reported health and long-term illnesses and disabilities. *Good*, *Fair*, and *Bad* are outcome variables split from a single question asking the individual about their general health. "Good" means the individual indicated "Very Good" or "Good", and "Bad" means the individual indicated "Bad" or "Very Bad". *Long Illness/Disability* asks the individual if they have a long-term illness or disability. The State Pension Age is 65 for men and 60 for women. * significant at 10%, ** significant at 5%, *** significant at 1%.

E Additional Tables on Mortality

Table E1: Regression Discontinuity Models on Specific Causes of Mortality, Men

(a) Specific ICD9 and ICD10 Causes

	Cause of Death							
	AMI	Heart Disease	Bronchopneumonia	Acute Cerebrovascular	Lung	Chronic airway	Cancer, Unspecified	Colon
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
State Pension Age	19.475	−12.089	8.038	0.093	53.555***	13.684	9.082	4.377
	(17.415)	(19.377)	(10.901)	(10.415)	(19.160)	(18.580)	(14.144)	(12.767)
Constant	1,202.175	1,091.445	142.555	171.483	934.659	317.718	239.192	210.997
Observations	49	49	49	49	49	49	49	49
Adjusted R^2	0.931	0.886	0.642	0.826	0.892	0.869	0.627	0.605

(b) Specific ICD9 and ICD10 Causes, Continued

	Cause of Death						
	Aortic anyuerism	Heart Failure	Prostate	Dementia	Stomach	Diabetes	Stroke
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
State Pension Age	−7.913	0.800	10.636	−1.809	−6.677	12.293**	8.308
	(9.568)	(6.379)	(12.731)	(4.856)	(9.089)	(6.230)	(6.321)
Constant	102.650	41.512	212.167	16.602	162.742	57.798	88.812
Observations	49	49	49	49	49	49	49
Adjusted R^2	0.787	0.560	0.808	0.531	0.724	0.416	0.746

Notes: Regression discontinuity estimates of reaching the State Pension Age on mortality for men. Each outcome variable is a specific ICD9 or ICD10 code for the primary cause of death. Robust standard errors in parenthesis.* significant at 10%, ** significant at 5%, *** significant at 1%.

Table E2: Regression Discontinuity Models on Specific Causes of Mortality, Women

(a) Specific ICD9 and ICD10 Causes

	Cause of Death							
	AMI	Heart Disease	Bronchopneumonia	Acute Cerebrovascular	Lung	Chronic airway	Cancer, Unspecified	Colon
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
State Pension Age	−14.930	20.169***	7.579	1.793	1.432	−17.994***	−22.301***	5.363
	(11.721)	(7.620)	(6.613)	(4.291)	(17.173)	(5.232)	(6.200)	(6.664)
Constant	230.428	170.750	49.917	46.704	307.607	118.557	135.386	86.993
Observations	49	49	49	49	49	49	49	49
Adjusted R^2	0.893	0.880	0.558	0.734	0.908	0.921	0.743	0.660

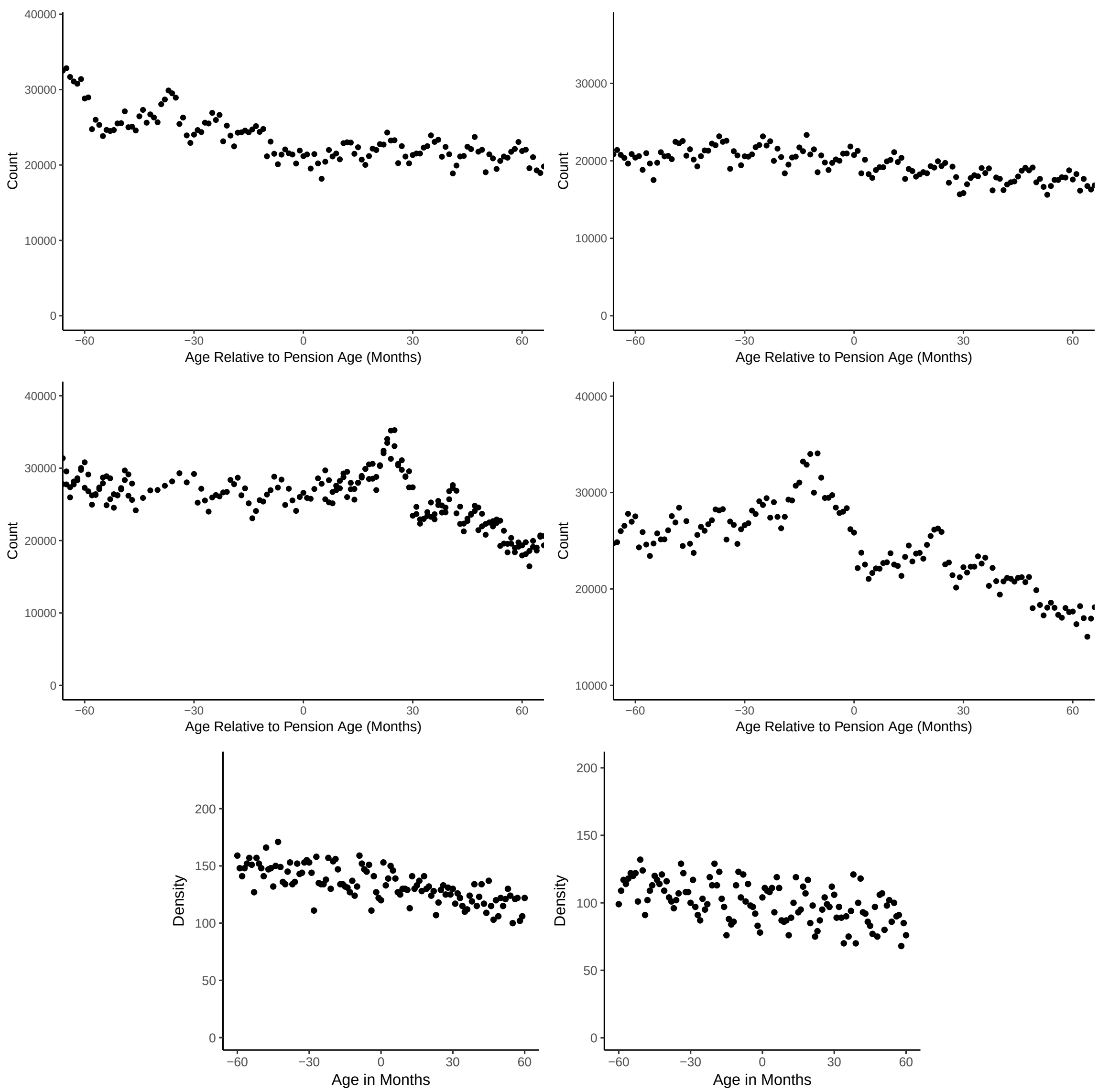
(b) Specific ICD9 and ICD10 Causes, Continued

	Cause of Death						
	Aortic anyuerism	Heart Failure	Breast	Dementia	Stomach	Diabetes	Stroke
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
State Pension Age	−3.393	5.264	19.467	1.352	0.244	9.201***	2.214
	(2.528)	(3.436)	(21.878)	(1.976)	(5.451)	(3.258)	(5.101)
Constant	15.595	9.125	367.240	6.075	36.063	24.704	23.077
Observations	49	49	49	49	49	49	49
Adjusted R^2	0.415	0.400	0.594	0.266	0.374	0.546	0.682

Notes: Regression discontinuity estimates of reaching the State Pension Age on mortality for women. Each outcome variable is a specific ICD9 or ICD10 code for the primary cause of death. Robust standard errors in parenthesis. * significant at 10%, ** significant at 5%, *** significant at 1%.

F Regression Discontinuity Balance Table and Density Figures

Figure F1: Age Densities



Notes: Density of age in months, clockwise from top left: 2001 Census (Women), 2001 Census (Men), 2011 Census (Men), BHPS (Men), BHPS (Men), and 2011 Census (Women).

Table F1: Regression Discontinuity Balance Estimates of Demographic Characteristics

(a) Men

	Educated	Race	Married	Race	Married	Educated
	(1)	(2)	(3)	(4)	(5)	(6)
State Pension Age	0.038	0.133	0.012	−0.039	0.086	0.002
	(0.026)	(0.138)	(0.021)	(0.026)	(0.179)	(0.009)
Constant	0.384	0.996	0.768	1.119	2.486	0.689
	(0.021)	(0.083)	(0.016)	(0.013)	(0.166)	(0.006)
Dataset	BHPS	BHPS	BPHS	HSE	HSE	ELSA
Observations	11,394	680	12,186	4,757	5,813	15,611
Adjusted R^2	0.010	0.005	0.000	−0.000	0.001	0.019

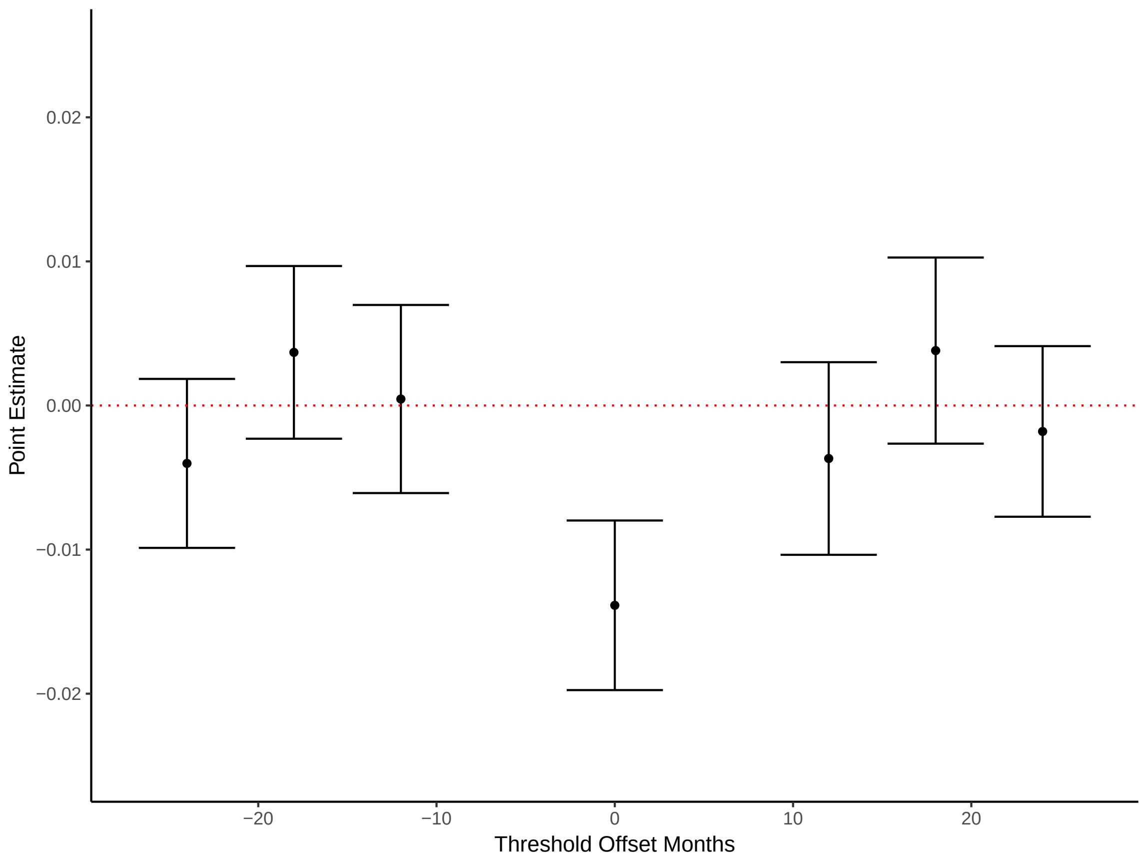
(b) Women

	Educated	Race	Married	Race	Married	Educated
	(1)	(2)	(3)	(4)	(5)	(6)
State Pension Age	0.038	0.133	0.012	−0.017	−0.033	−0.001
	(0.026)	(0.138)	(0.021)	(0.045)	(0.079)	(0.014)
Constant	0.384	0.996	0.768	1.110	2.859	0.676
	(0.021)	(0.083)	(0.016)	(0.043)	(0.073)	(0.012)
Dataset	BHPS	BHPS	BPHS	HSE	HSE	ELSA
Observations	11,394	680	12,186	5,494	7,154	17,966
Adjusted R^2	0.010	0.005	0.000	0.002	0.007	0.027

Notes: Regression discontinuity estimates of demographic characteristics to check for balance across the pension age threshold. Robust standard errors in parenthesis. * significant at 10%, ** significant at 5%, *** significant at 1%.

G Regression Discontinuity Robustness Figures

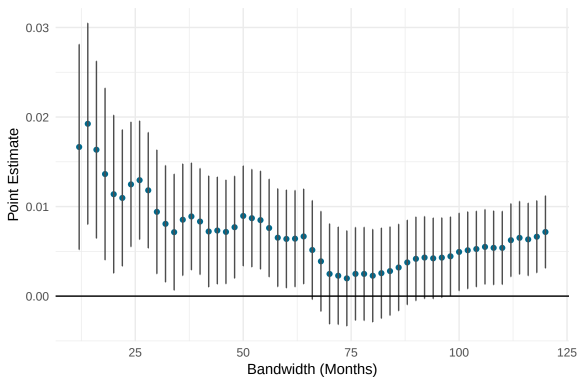
Figure G1: Regression Discontinuity Placebo Test



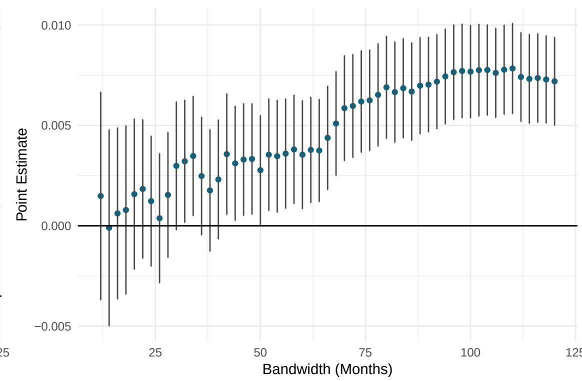
Notes: RD placebo estimates of the proportion of men reporting bad health in the 2001 Census. The y-axis shows the point estimates with 95 percent confidence intervals, and the x-axis shows age thresholds that differ from the State Pension Age by the indicated number of months. Estimates are produced using a one-year bandwidth.

Figure G2: Bandwidth Sensitivity for Self-Reported Health from the 2001 and 2011 Censuses, Men

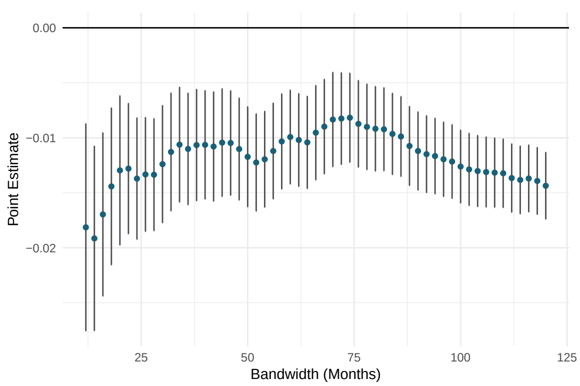
(a) Men in Good or Very Good Health, 2001



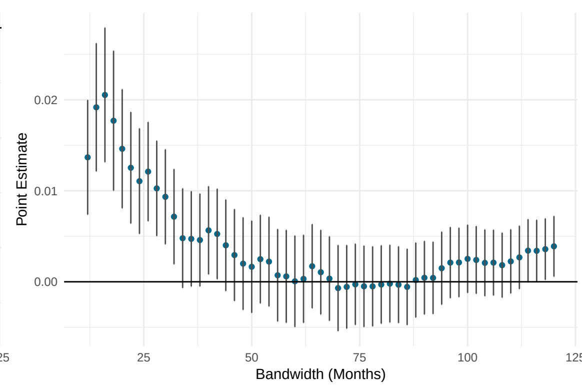
(b) Men in Fair Health, 2001



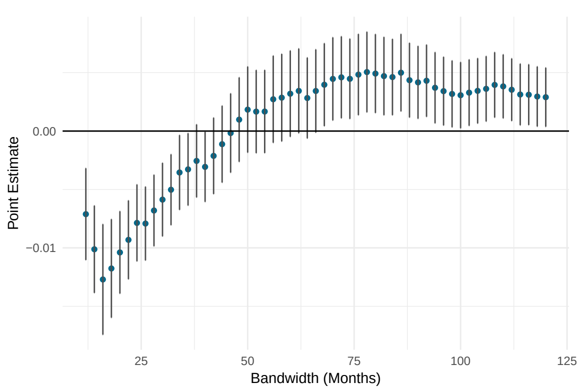
(c) Men in Bad or Very Bad Health, 2001



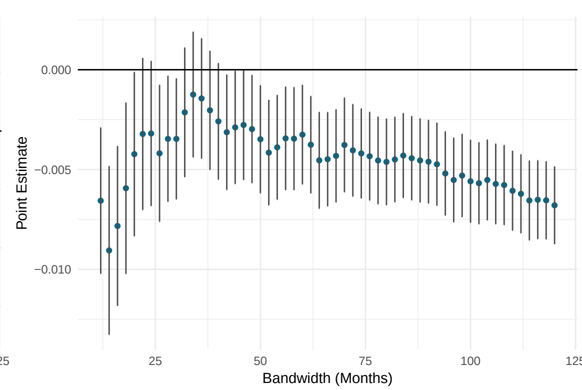
(d) Men in Good or Very Good Health, 2011



(e) Men in Fair Health, 2011



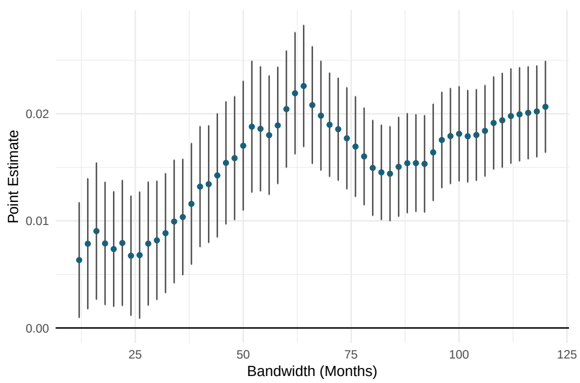
(f) Men in Bad or Very Bad Health, 2011



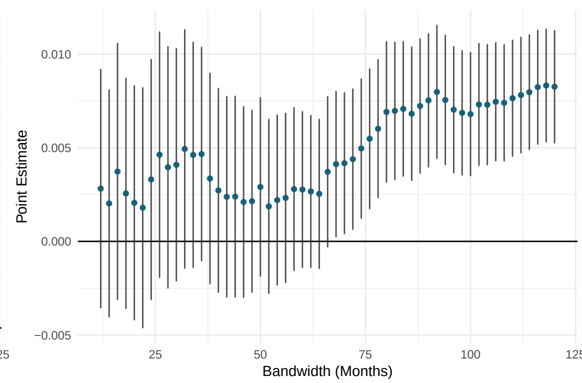
Notes: Bandwidth sensitivity figures for the proportion of the male population reporting good or very good health, fair health, or bad or very bad health, respectively, from the 2001 and 2011 England/Wales censuses. Each point is the result of a regression with the bandwidth listed on the x-axis.

Figure G3: Bandwidth Sensitivity for Self-Reported Health from the 2001 and 2011 Censuses, Women

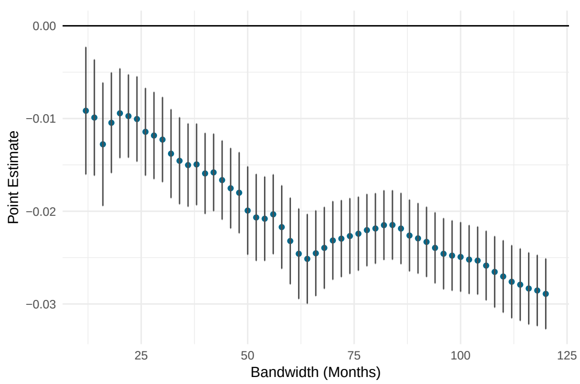
(a) Women in Good or Very Good Health, 2001



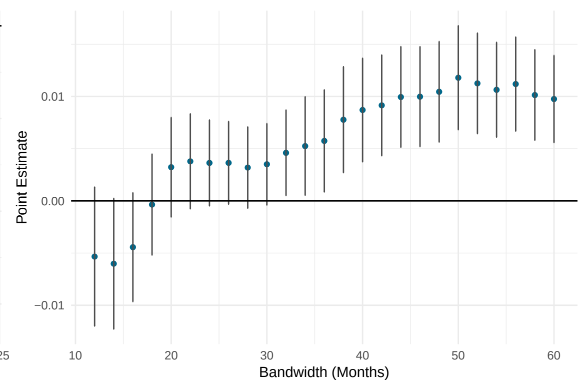
(b) Women in Fair Health, 2001



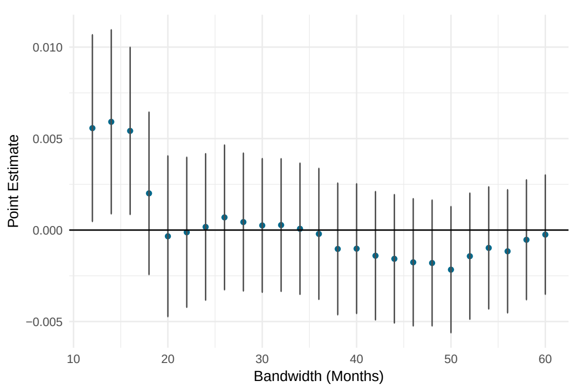
(c) Women in Bad or Very Bad Health, 2001



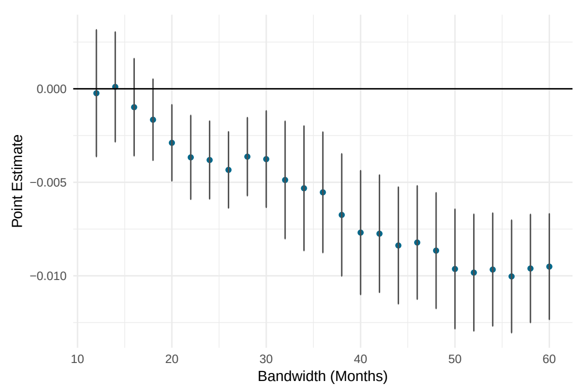
(d) Women in Good or Very Good Health, 2011



(e) Women in Fair Health, 2011

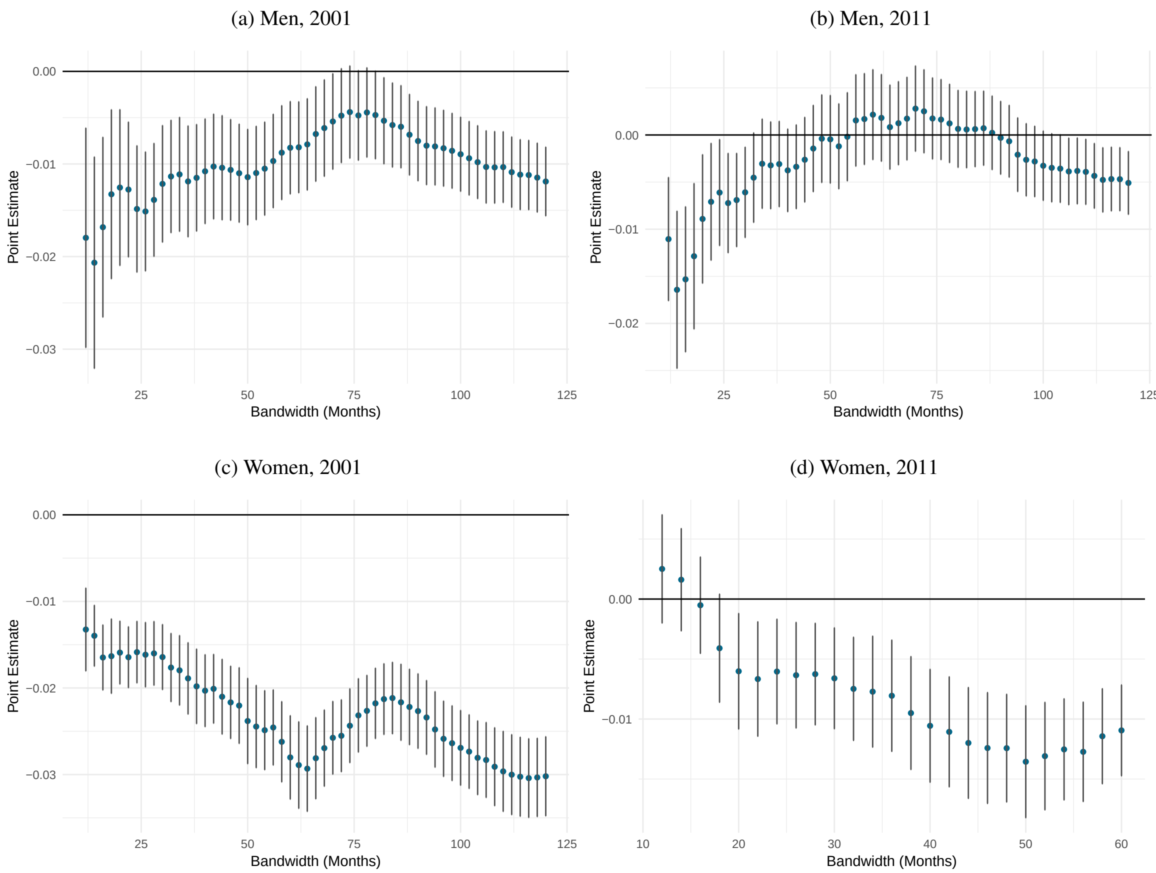


(f) Women in Bad or Very Bad Health, 2011



Notes: Bandwidth sensitivity figures for the proportion of the male population reporting good or very good health, fair health, or bad or very bad health, respectively, from the 2001 and 2011 England/Wales censuses. Each point is the result of a regression with the bandwidth listed on the x-axis.

Figure G4: Age Profile of Long-Term Illness or Disability from 2001 and 2011 Census



Notes: Bandwidth sensitivity for self-reported long-term illness or disability status from the 2001 and 2011 Censuses. Each point is the result of a regression with the bandwidth listed on the x-axis.